



Air Quality Monitoring

Fort Saskatchewan and Redwater Area

May 2001 to March 2002

Final Report

Summary

Alberta Environment conducts mobile air quality surveys each year as part of its air quality monitoring program in Alberta. These monitoring surveys are unannounced and use the department's *Mobile Air Monitoring Laboratory* (MAML). The MAML monitoring provides a "snapshot" in time and space of the air quality at the location monitored. Pollutants measured by the MAML included carbon monoxide, oxides of nitrogen, ozone, particulate matter, hydrocarbons, sulphur dioxide, hydrogen sulphide, total reduced sulphur and ammonia.

Alberta Environment conducted a mobile, ambient air quality monitoring survey in the Fort Saskatchewan and Redwater area. A total of 137 hours of data were collected over 20 sampling days at 17 locations during the spring, summer and fall of 2001 and winter of 2002. In addition to the MAML monitoring, portable samplers were deployed to monitor for Volatile Organic Compounds (VOC's), which were analyzed for 153 compounds. Each site was monitored for a minimum of one hour to allow comparison with applicable Alberta one-hour Ambient Air Quality Guidelines. Monitoring sites were selected to provide data near populated areas and near industrial sites.

The objectives for the survey were to determine air quality near residences and industrial facilities in the area and to provide data to support air quality monitoring and modeling activities that have previously been conducted in the area.

This report presents the data collected by the MAML during the spring (May 16 to 18, 22 and 23, 2001), summer (July 18 to 20, 26 and 27, 2001), fall (November 7 to 9, 13 and 15, 2001), and winter (February 25 to 28, and March 1, 2002), as well as the VOC data collected by stationary samplers deployed during the survey period.

No exceedances of applicable guidelines occurred. Ambient levels of all air quality parameters measured by the MAML were below Alberta's Ambient Air Quality Guidelines.

Findings

1) Concentrations of the air pollutants monitored in the Fort Saskatchewan and Redwater area survey were below Alberta's Ambient Air Quality (AAAQ) Guidelines¹. Alberta has one-hour air quality guidelines for carbon monoxide, nitrogen dioxide, ozone, sulphur dioxide, hydrogen sulphide and ammonia. Maximum one-hour concentrations for these pollutants were:

- 28% of the one-hour guideline for ammonia (NH₃).
- 17% of the one-hour guideline for carbon monoxide (CO).
- 30% of the one-hour guideline for hydrogen sulphide (H₂S).
- 24% of the one-hour guideline for nitrogen dioxide (NO₂).
- 60% of the one-hour guideline for ozone (O₃).
- 13% of the one-hour guideline for sulphur dioxide (SO₂).

Table 1 summarizes the monitoring results and relates results to applicable guidelines.

Table 1: Summary of Monitoring Results and Ambient Guidelines for the Fort Saskatchewan and Redwater Area MAML survey for May 2001 to March 2002.

Pollutant	Units	Range		Median	Alberta Ambient One Hour Guideline	# of Guideline Exceedances
		Minimum	Maximum			
Ammonia (NH ₃)	ppm	<0.001	0.557	0.001	2.0	0
Carbon Monoxide (CO)	ppm	<0.1	2.2	0.3	13.0	0
Hydrocarbons	Methane (CH ₄)	ppm	1.7	3.6	2.1	n/a
	Reactive Hydrocarbons (RHC)	ppm	<0.005	0.5	0.1	n/a
	Total Hydrocarbons (THC)	ppm	1.7	3.6	2.1	n/a
Hydrogen Sulphide (H ₂ S)	ppm	<0.0006	0.003	<0.0006	0.010	0
Oxides of Nitrogen	Nitric Oxide (NO)	ppm	<0.001	0.164	0.003	n/a
	Nitrogen Dioxide (NO ₂)	ppm	<0.001	0.051	0.004	0
	Total Oxides of Nitrogen (NO _x)	ppm	<0.001	0.212	0.007	n/a
Ozone (O ₃)	ppm	0.001	0.049	0.029	0.082	0
Particulate Matter	PM ₁₀	µg/m ³	<1	323	22	n/a
	PM _{2.5}	µg/m ³	<1	24	3	n/a
	TSP	µg/m ³	5	547	39	n/a
Polycyclic Aromatic Hydrocarbons (PAH)	ng/m ³	<3	70	<3	n/a	n/a
Sulphur Dioxide (SO ₂)	ppm	0.000	0.022	0.001	0.172	0
Total Reduced Sulphur (TRS)	ppm	<0.0006	0.004	<0.0006	n/a	n/a

µg/m³-micrograms per cubic metre of air

ppm-parts per million

n/a-no one hour guideline

ng/m³-nanograms per cubic metre of air

2) Volatile Organic Compounds (VOCs)

VOC concentrations did not exceed applicable AAAQ Guidelines, Ontario's Half-hour Point of Impingement Limits, Ontario's Ambient Air Quality Criteria, or known odour threshold ranges^{2,3}. Concentrations of the 153 VOCs analyzed in the twelve samples are presented with the applicable guidelines and odour thresholds in Table 17 on page 35 of this report.

¹ Alberta Ambient Air Quality Guidelines. Alberta Environment. February 2000.

² Odour Thresholds and Irritation Levels of Several Chemical substances: A review. Jon Ruth. Am. Ind. Hyg. Assoc. J (47). 1986.

³ 3M 2001 Respirator Selection Guide. 3M. www.3m.com. 2001.

⁴ Summary of Point of Impingement Standards, Point of Impingement Guidelines and Ambient Air Quality Criteria (AATCs). Standards Development Branch, Ontario Ministry of the Environment. September 2001.

Alberta's Ambient Air Quality Guidelines (AAAQ Guideline)

Alberta's Ambient Air Quality Guidelines⁵ are established under Section 14 of the Environmental Protection and Enhancement Act (EPEA). EPEA provides for the development of guidelines and ambient environmental quality objectives for Alberta.

The Ambient Air Quality Guidelines are used for:

- reporting on the state of the atmospheric environment in Alberta.
- reporting to Albertans on the quality of air through an air quality index (AQI).
- establishing approval conditions for regulated industrial facilities.
- evaluating proposals to construct facilities that will have air emissions.
- guiding special ambient air quality surveys.
- assessing compliance near major industrial air emission sources.

Some of Alberta's Ambient Air Quality Guidelines are based on odour perception. This is the case for sulphur dioxide, hydrogen sulphide, ammonia and nitrogen dioxide. For these chemicals, people are likely to detect an odour at concentrations well below levels that may affect human health.

Alberta's Ambient Air Quality Guidelines for one-hour concentrations of parameters monitored by the MAML and the basis for the guideline are listed in Table 2.

Table 2: Alberta's Ambient Air Quality Guidelines for Parameters Monitored by the MAML.

AIR QUALITY PARAMETER	ONE-HOUR GUIDELINE (PPM*)	BASIS FOR GUIDELINE
ammonia	2	odour perception
carbon monoxide	13	oxygen carrying capacity of blood
hydrogen sulphide	0.01	odour perception
nitrogen dioxide	0.212	odour perception
ozone	0.082	reduction of lung function and effects on tomatoes
sulphur dioxide	0.172	taste, odour perception and effects on bluegrass

*Parts per million by volume.

⁵ *Alberta Ambient Air Quality Guidelines*. Alberta Environment. February 2000.

Monitoring Using the Mobile Air Monitoring Laboratory

Alberta Environment monitored air quality using the *Mobile Air Monitoring Laboratory* (MAML) in the Fort Saskatchewan and Redwater area from May 2001 to March 2002. During the survey, samples were collected at locations in and near the communities of Fort Saskatchewan and Redwater, near industrial facilities, and along Highway 21 between the City of Edmonton and the City of Fort Saskatchewan. Air quality was monitored on the following dates:

- Spring (May 16 - 18, 22 and 23, 2001).
- Summer (July 18 - 20, 26 and 27, 2001).
- Fall (November 7 - 9, 13 and 15, 2001).
- Winter (February 25 - 28, and March 1, 2002).

A total of 137 hours of data were collected at 17 locations. The monitoring sites were selected based on consultation with staff from Alberta Environment and stakeholders in the area. Monitoring was conducted for a minimum of one hour at each location to allow comparison with Alberta's Ambient Air Quality Guidelines. Please refer to Figure 2 for a map of the monitoring locations, and to Table 3, on page 5, for a listing of the sites.

The Mobile Air Monitoring Laboratory

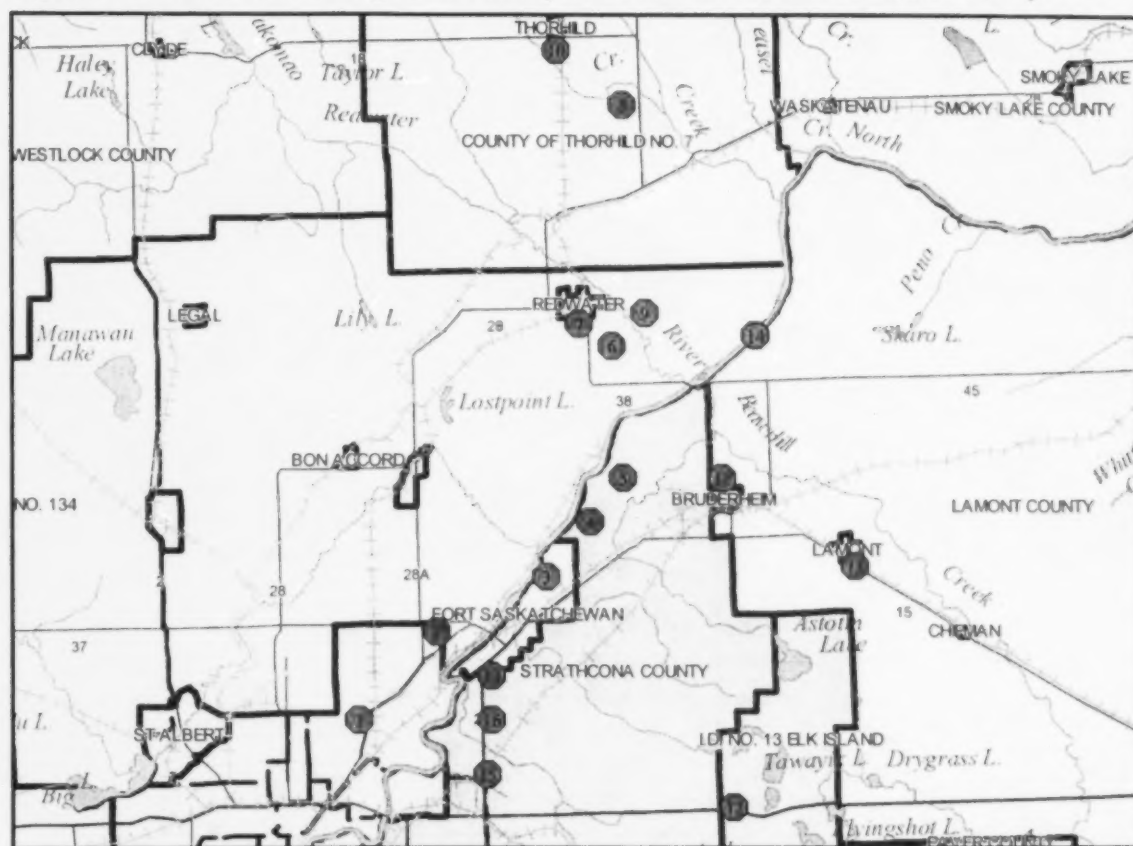
The MAML is a 27-foot (8.2 m) vehicle specially designed and equipped to measure air quality. The MAML monitoring provides a "snapshot" in time and space of the air quality at the location monitored. It houses a variety of instruments that continuously sample air at specified times or distance intervals. The MAML is equipped with:

- a dual computer system custom-programmed to accept and record the measurement of air samples from each analyzer.
- a GPS (Global Positioning System) that identifies the MAML's location as it moves around Alberta.
- an exhaust purifying system that minimizes emissions from the vehicle.
- two on-board generators that are also equipped with exhaust scrubbers.

The parameters measured by the MAML are listed in Table 4, on page 6.

Figure 1: Alberta Environment's Mobile Air Monitoring Laboratory (MAML).



Figure 2: MAML Monitoring Locations (Fort Saskatchewan/Redwater Area).**Table 3: Monitoring Locations and Associated Site Numbers.**

Site #	Monitoring Location		Dates Monitored			
			May-2001	July-2001	Nov-2001	Feb/Mar-2002
1	Edmonton City limits & Hwy 15	Manning Drive, 1 block N of 167 ave	17, 23	19, 27	8, 15	26, 01
2	Hwy 15 & Hwy 37	Rge Rd 231 between Hwy 15 & 37	17, 23	19, 27	8, 15	26, 01
3	Ft. Sask City Center	Jarvis Park, 1 block W of 101 st on 100 ave	16, 18	18, 20	7, 9	25, 27
4	Fenceline between Dow & Sherritt	On 119 st, downwind of either Dow or Sherritt plants	16, 18	18, 20	7, 9	25, 27
5	Shell Scotford	Downwind of Shell Scotford plant at nearest road access	16, 23	18, 27	7, 15	25, 01
6	Agrium Redwater	Downwind of Agrium Redwater plant at nearest road access	17, 22	19, 26	8, 13	26, 28
7	Redwater Town Center	Lions Park, 1 block N of Hwy 38	17, 22	19, 26	8, 13	26, 28
8	Egremont Town Center	Sacred Heart Church	17, 22	19, 26	8, 13	26, 28
9	Redwater River valley	Redwater River bridge Twp Rd 548 between RR225 & RR230	17, 22	19, 26	8, 13	26, 28
10	Thorhild Town Center	Centennial Park, 5 st & 6 ave	17, 22	19, 26	8, 13	26, 28
11	Bruderheim Town Center	Arena parking lot at 50 st & 52 ave	16, 18	18, 20	7, 9	26, 27
12	Hwy 16 & Elk Island Park	Rge Rd 212 & Hwy 16	18, 23	20, 27	9, 15	27, 01
13	Lamont Town Center	52 st & 52 ave	16, 18	18, 20	7, 9	25, 27
14	N. Sask River Valley	Lamoureux Dr. 1km S of Hwy 15 on W side of N Sask. River	18, 23	20, 27	9, 15	27, 01
15	Hwy 21 4km north of Hwy 16	Twp Rd 534 & Hwy 21	16, 22	18, 26	7, 13	25, 28
16	Hwy 21 7km north of Hwy 16	Twp Rd 540 & Hwy 21	23	20, 27	9, 15	27, 01
17	Hwy 21 at Ft. Sask City limits	Dow Centennial Ball fields at Rge Rd 231 & Twp Rd 543	16, 22	18, 26	7, 13	25, 28

Figure 2: MAML Monitoring Locations (Fort Saskatchewan/Redwater Area).



Table 3: Monitoring Locations and Associated Site Numbers.

Site #	Monitoring Location	Dates Monitored				
		May-2001	July-2001	Nov-2001	Feb-Mar-2002	
1	Edmonton City limits & Hwy 15	Manning Drive, 1 block N of 167 ave	17, 23	10, 27	8, 15	26, 01
2	Hwy 15 & Hwy 37	Rge Rd 231 between Hwy 15 & 37	17, 23	19, 27	8, 15	26, 01
3	Ft. Sask City Center	Jarvis Park, 1 block W of 101 st on 100 ave	16, 18	18, 20	7, 9	25, 27
4	Fenceline between Dow & Sherritt	On 119 st, downwind of either Dow or Sherritt plants	16, 18	18, 20	7, 9	25, 27
5	Shell Scotford	Downwind of Shell Scotford plant at nearest road access	16, 23	18, 27	7, 15	26, 01
6	Agrium Redwater	Downwind of Agrium Redwater plant at nearest road access	17, 22	19, 26	8, 13	26, 28
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12	Hwy 16 & Elk Island Park	Rge Rd 212 & Hwy 16	18, 23	20, 27	9, 15	27, 01
13	Lamont Town Center	52 st & 52 ave	16, 18	18, 20	7, 9	26, 27
14	N. Sask River Valley	Lamoureux Dr, 1km S of Hwy 15 on W side of N Sask River	19, 23	20, 27	8, 15	27, 01
15	Hwy 21 4km north of Hwy 16	Twp Rd 534 & Hwy 21	16, 22	18, 26	7, 13	25, 28
16	Hwy 21 7km north of Hwy 16	Twp Rd 540 & Hwy 21	23	20, 27	8, 15	27, 01
17	Hwy 21 at Ft. Sask City limits	Dow Centennial Ball fields at Rge Rd 231 & Twp Rd 543	16, 22	18, 26	7, 13	25, 28

Table 4: Parameters monitored for the Fort Saskatchewan and Redwater area survey, instrument detection limits and operating ranges.

Parameter Measured		Detection Limit*	Operating Range**
Ammonia (NH ₃)		0.001 ppm	5 ppm
Carbon Monoxide (CO)		0.1 ppm	50 ppm
Hydrocarbons	Methane (CH ₄)	0.005 ppm	10 ppm
	Reactive Hydrocarbons (RHC)	0.005 ppm	20 ppm
	Total Hydrocarbons (THC)	0.005 ppm	20 ppm
Hydrogen Sulphide (H ₂ S)		0.0006 ppm	1 ppm
Oxides of Nitrogen	Nitric Oxide (NO)	0.001 ppm	1 ppm
	Nitrogen Dioxide (NO ₂)	0.001 ppm	1 ppm
	Total Oxides of Nitrogen (NO _x)	0.001 ppm	1 ppm
Ozone (O ₃)		0.001 ppm	0.5 ppm
Particulates	Inhalable Particulates (PM ₁₀)	1 µg/m ³	1.0 g/m ³
	Respirable Particulates (PM _{2.5})	1 µg/m ³	1.0 g/m ³
	Total Suspended Particulates (TSP)	1 µg/m ³	1.0 g/m ³
Polycyclic Aromatic Hydrocarbons (PAHs)		3 ng/m ³	1000 ng/m ³
Sulphur Dioxide (SO ₂)		0.0006 ppm	1 ppm
Total Reduced Sulphur (TRS)		0.0006 ppm	1 ppm
Relative Humidity (RH)		0 %	100 %
Temperature (Temp)		-40 °C	50 °C
Wind Direction (WDR)		0 degrees	360 degrees
Wind Speed (WSP)		0 km/h	200 km/h

ppb = parts per billion

µg/m³ = micrograms per cubic metre

°C = degrees Celsius

ppm = parts per million

g/m³ = grams per cubic metre

% = per cent

ng/m³ = nanograms per cubic metre

km/h = kilometres per hour

* The **detection limit** indicates the *minimum* amount of pollutant the instrument can measure.

** The **operating range** indicates the *maximum* amount of pollutant the instrument can detect. This limit is set to provide the optimum precision over that range. The upper limit can be raised, however, precision at the lower levels (where most levels are monitored) is then compromised.

Results

Ammonia (NH₃)

Maximum one-hour concentration recorded during the survey	One-hour AAAQ guideline
0.557 ppm	2.0 ppm

Ammonia is a colourless gas with the well-known pungent odour found in household cleaners. NH₃ is produced both by natural and man-made sources. Some natural sources of NH₃ include the decay of plant material and animal waste. A small portion is also released during respiration. In Alberta, the fertilizer industry is the main industrial source of NH₃. Another major source of NH₃ are commercial feedlots, due to large amounts of animal waste present.

One-hour average concentrations of ammonia (NH₃) in the survey area ranged from less than 0.001 ppm to a maximum of 0.557 ppm. This maximum concentration of NH₃ is 28% of the one-hour guideline. The median one-hour average level of NH₃ for the survey was 0.001 ppm. Levels of NH₃ did not exceed the one-hour guideline at any monitoring sites. Please

refer to Tables 5 and 6, page 24 for the data set.

The highest one-hour NH₃ concentration detected during the survey (0.557 ppm) was measured at Site # 4 (downwind and east of Sherritt) on May 18, 2001. The MAML operator noted strong west winds and odours. Maximum one-hour NH₃ concentrations from other MAML surveys ranged from 0.020 ppm in the City of Lethbridge (1998/1999) to 1.364 ppm during the 1998/1999 survey conducted north of Lethbridge. Please refer to Table 8, page 26 for the data set.

The median NH₃ concentration was very low with a value of 0.001 ppm, which is the detection limit. Therefore 50% of the data for NH₃ was below the detection limit. Median NH₃ concentrations from other MAML air quality surveys conducted in Alberta ranged from 0.001 to 0.075 ppm. Please refer to Table 7, page 25 for the data set.

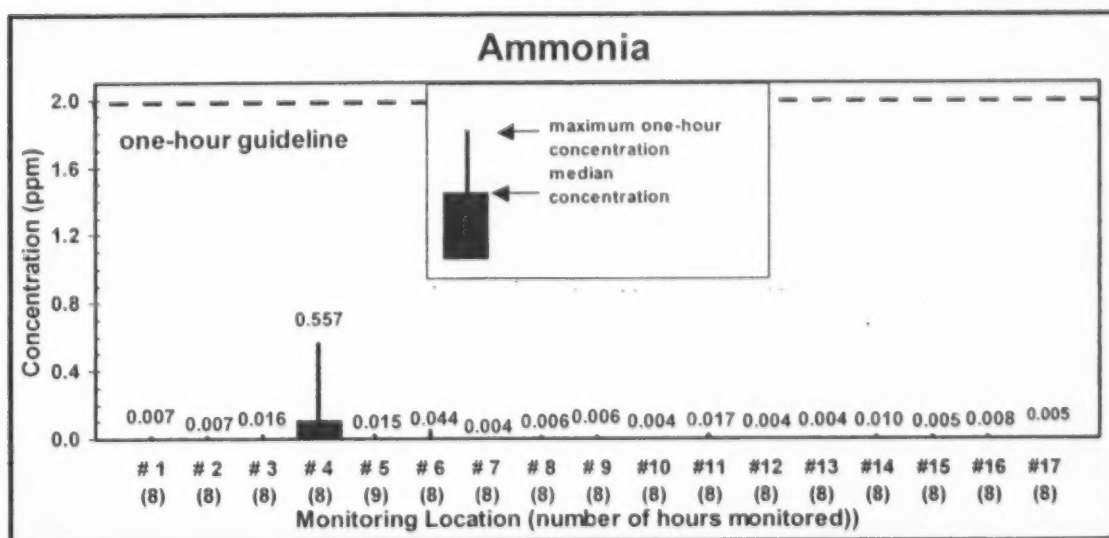


Figure 3: One-hour median and maximum concentrations for ammonia.

Carbon Monoxide (CO)

Maximum one-hour concentration recorded during survey	One-hour AAAQ guideline
2.2 ppm	13.0 ppm

Carbon monoxide (CO) is a colourless, odourless gas emitted into the atmosphere primarily by motor vehicles. Minor sources include fireplaces, industry, aircraft and natural gas combustion. The major source of carbon monoxide at urban locations is vehicle emissions.

None of the CO concentrations measured exceeded the one-hour Alberta ambient air quality guideline of 13.0 ppm. One-hour concentrations of carbon monoxide (CO) ranged from less than 0.1 ppm to a maximum of 2.2 ppm; which represents 17% of the one-hour Alberta ambient air quality guideline for CO. The median concentration during the survey was 0.3 ppm. Please refer to Table 5 and 6, page 24 for the data set.

The maximum one-hour CO concentration of 2.2 ppm was recorded at Site # 7 on November 13, 2001. Close proximity of the MAML to a major traffic artery during a peak traffic period likely contributed to CO levels. Maximum one-hour CO concentrations ranged from 0.7 (Whitecourt/Swan Hills/Shiningbank Lake, 2000/2001) to 2.8 ppm (City of Medicine Hat, 1998/1999) during other MAML mobile surveys. Maximum CO levels at the permanent Edmonton and Calgary monitoring stations ranged from 2.8 to 11.2 ppm in 2001. Please refer to Table 8, page 26 for the data set.

The median concentration in the Fort Saskatchewan/Redwater area survey was 0.3 ppm. Median CO concentrations at other mobile surveys in Alberta ranged from 0.2 to 0.4 ppm. At urban locations such as Edmonton and Calgary, median CO levels ranged from 0.3 to 0.5 ppm (based on 2001 data collected from permanent continuous monitoring stations). Please refer to Table 7, page 25, for the data set.

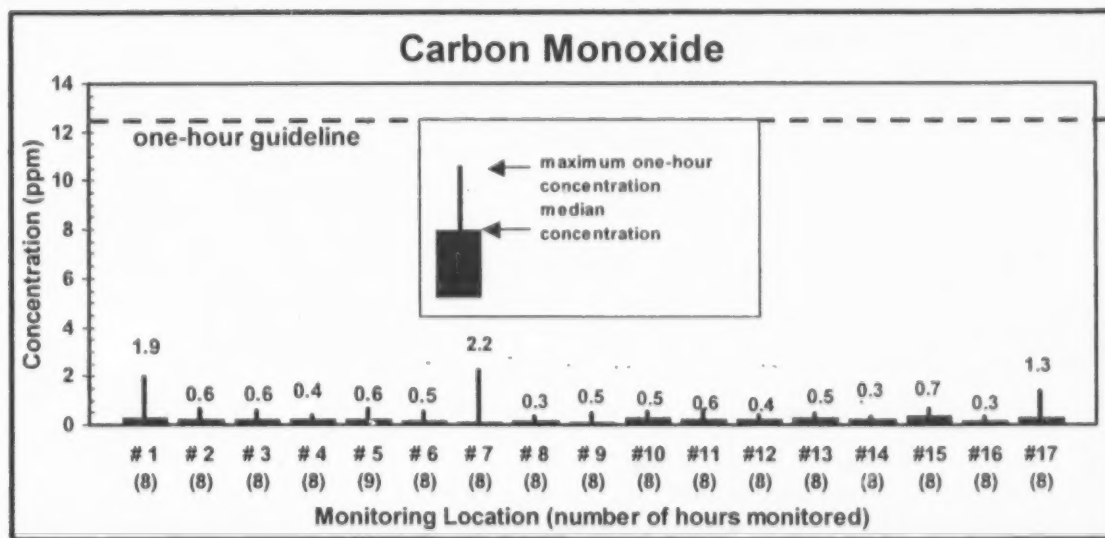


Figure 4: One-hour median and maximum concentrations for carbon monoxide.

Hydrocarbons (THC, RHC and CH₄)

Maximum one-hour concentration recorded during survey	One-hour AAAQ guideline
THC = 3.6 ppm	no guideline
RHC = 0.5 ppm	no guideline
CH ₄ = 3.6 ppm	no guideline

"Total hydrocarbons" (THC) refers to a broad family of chemicals that contain carbon and hydrogen atoms. Methane (CH₄), a non-reactive hydrocarbon, is the most common hydrocarbon in the earth's atmosphere. Specific reactive hydrocarbons (RHC) are important because they can react with oxides of nitrogen in the presence of sunlight to form ozone, and they can be toxic (at high concentrations) to humans, animals or vegetation. Sources of hydrocarbons include vegetation, vehicle emissions, gasoline stations and gasoline storage tanks, petroleum and chemical industries, dry cleaning, fireplaces, natural gas combustion, and aircraft traffic. Hydrocarbons are also emitted by fugitive sources such as evaporation of solvents, or leaking valves, flanges, pumps and compressors at industrial facilities. Incinerator and flare stacks can also be sources of hydrocarbons. Many hydrocarbons, such as CH₄, are emitted by natural sources. Background THC concentrations recorded in rural Alberta range from 1.5 to 2.0 ppm. Background hydrocarbons are primarily composed of CH₄ with a small contribution from RHC (about 0.2 ppm).

One-hour concentrations of total hydrocarbons (THC) ranged from 1.7 ppm to a maximum of 3.6 ppm. The median concentration was 2.1 ppm. One-hour concentrations of methane

(CH₄) ranged from 1.7 ppm to a maximum of 3.6 ppm. The median concentration was 2.1 ppm. One-hour concentrations of reactive hydrocarbons (RHC) ranged from less than 0.005 ppm to a maximum of 0.546 ppm. The median concentration was 0.051 ppm. Alberta does not have a one-hour guideline for hydrocarbons. Please refer to Tables 5 and 6, page 24 for the data set.

The maximum THC concentration of 3.6 ppm was detected at Site # 17 (Hwy 21 at Fort Saskatchewan, City limits), on November 13, 2001. Maximum levels of CH₄ (3.6 ppm) were also detected at this location at the same time, along with elevated readings of oxides of nitrogen, carbon monoxide, sulphur dioxide and particulates. Hydrocarbons at this location were likely due to vehicle emissions from the nearby roadway carrying large traffic volumes, and close proximity to petroleum and chemical industries. Hydrocarbon levels elevated beyond background levels were detected at most other monitoring sites.

Maximum THC levels from other MAML surveys ranged from 2.2 ppm in the Lethbridge area (1998/1999) to 32.4 ppm in the Grande Prairie area (1998/1999). Maximum one-hour THC levels ranged from 3.5 to 25.0 ppm at permanent monitoring stations in Alberta in 2001. Please refer to Table 8, page 26 for the data set.

The median THC level in the Fort Saskatchewan/Redwater area survey was 2.1 ppm. Median THC levels at permanent continuous monitoring stations in Alberta ranged from 1.8 to 2.2 ppm. Please refer to Table 7, page 25 for the data set.

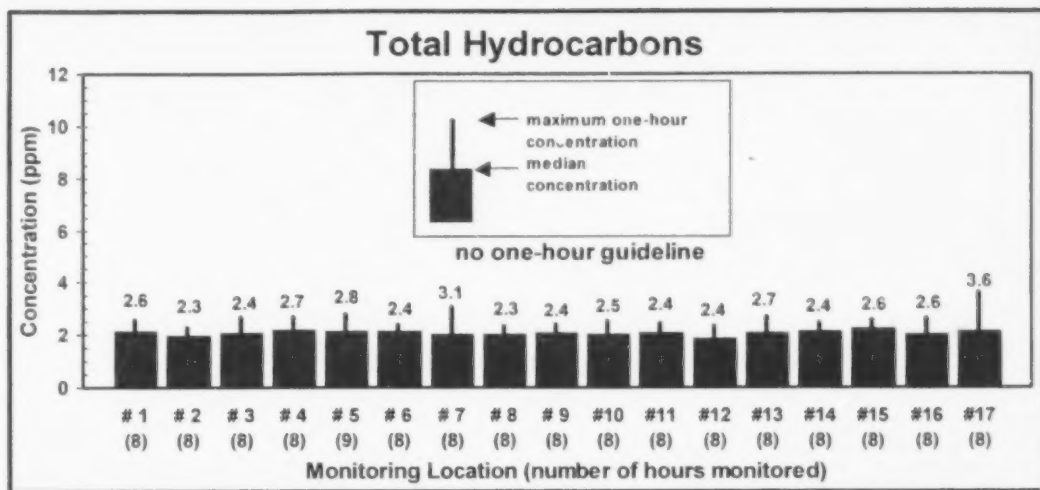


Figure 5: One-hour *median* and *maximum* concentrations for total hydrocarbons.

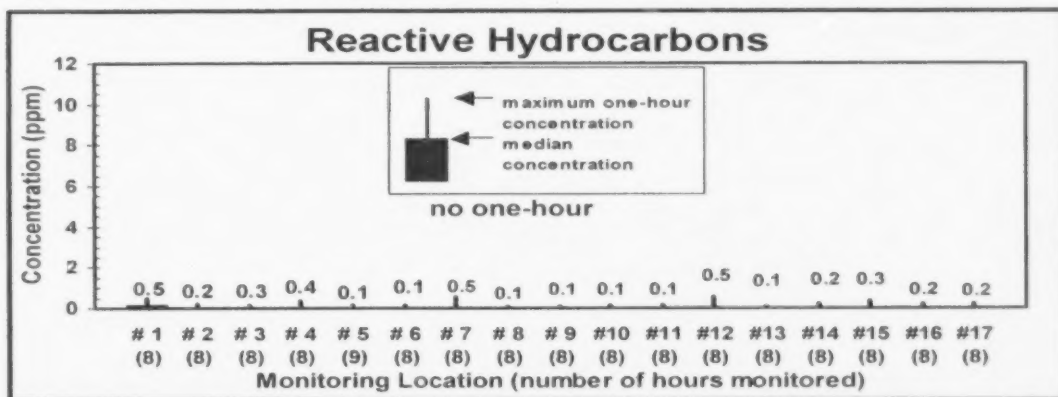


Figure 6: One-hour *median* and *maximum* concentrations for reactive hydrocarbons

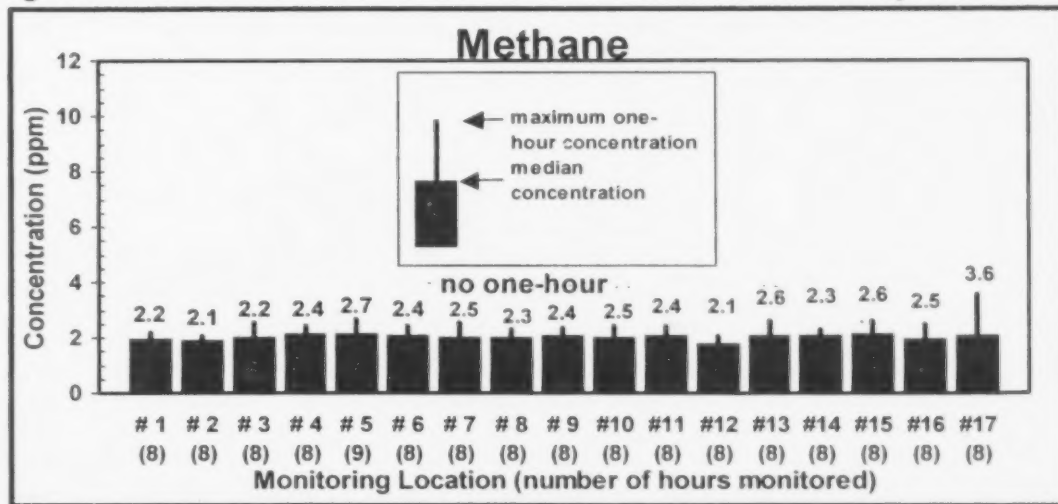


Figure 7: One-hour *median* and *maximum* concentrations for methane.

Hydrogen Sulphide and Total Reduced Sulphur (H₂S and TRS)

Maximum one-hour concentration recorded during survey	One-hour AAAQ guideline
H ₂ S = 0.003 ppm TRS = 0.004 ppm	0.010 ppm no guideline

Hydrogen sulphide (H₂S) is a colourless gas with a rotten egg odour. Total reduced sulphur (TRS) includes hydrogen sulphide, mercaptans, dimethyl sulphide, dimethyl disulphide and other sulphur compounds. Sulphur dioxide is not included in the determination of TRS. Industrial sources of H₂S and TRS include fugitive emissions (leakages) from petroleum refineries, tank farms for unrefined petroleum products, natural gas plants, petrochemical plants, oil sands plants, sewage treatment facilities, pulp and paper plants that use the Kraft pulping process, and animal feedlots. Natural sources of H₂S include sulphur hot springs, sloughs, swamps and lakes.

None of the H₂S concentrations measured exceeded the one-hour Alberta ambient air quality guideline of 0.01 ppm. One-hour concentrations of hydrogen sulphide (H₂S) ranged from less than 0.0006 ppm to a maximum of 0.003 ppm; which represents 30% of the one-hour guideline. The median concentration was less than 0.0006 ppm. Please refer to Tables 5 and 6, page 24, for the data set.

The maximum one-hour concentration of 0.003 ppm was measured at Site # 15 on July 26, 2001, (the MAML was positioned

approximately 40 metres to the east of a lagoon) and at Site # 17 on November 13, 2001 (a blue-grey haze was noted in the area at the time). Maximum one-hour H₂S concentrations measured during other MAML surveys in Alberta ranged from 0.002 ppm during the Bow Corridor survey (1999/2000) to 0.054 ppm in the Lethbridge area (1998/1999 survey). Based on 2001 data, maximum one-hour H₂S levels at the AENV monitoring stations ranged from 0.005 ppm (Fort Saskatchewan) to 0.038 ppm (Calgary East). See Table 8, page 26, for the complete data set.

The median one-hour H₂S concentration was less than 0.0006 ppm. Median one-hour H₂S concentrations measured during other MAML surveys in Alberta ranged from less than 0.0006 ppm to 0.001 ppm in the Lethbridge area (Picture Butte, Sterling). See Table 7, page 25, for the complete data set.

One-hour concentrations of total reduced sulphur (TRS) ranged from less than 0.0006 ppm to a maximum of 0.004 ppm. The median one-hour concentration of TRS for the survey was less than 0.0006 ppm. There is no one-hour guideline for TRS in Alberta.

The maximum one-hour TRS concentration of 0.004 ppm was recorded at Site # 4, (downwind and east of Sherritt) on May 18, 2001. The technician on the MAML noted a strong west wind, with chemical and ammonia odours in the vicinity. Sulphur compounds at this location were likely due to emissions from the nearby plant.

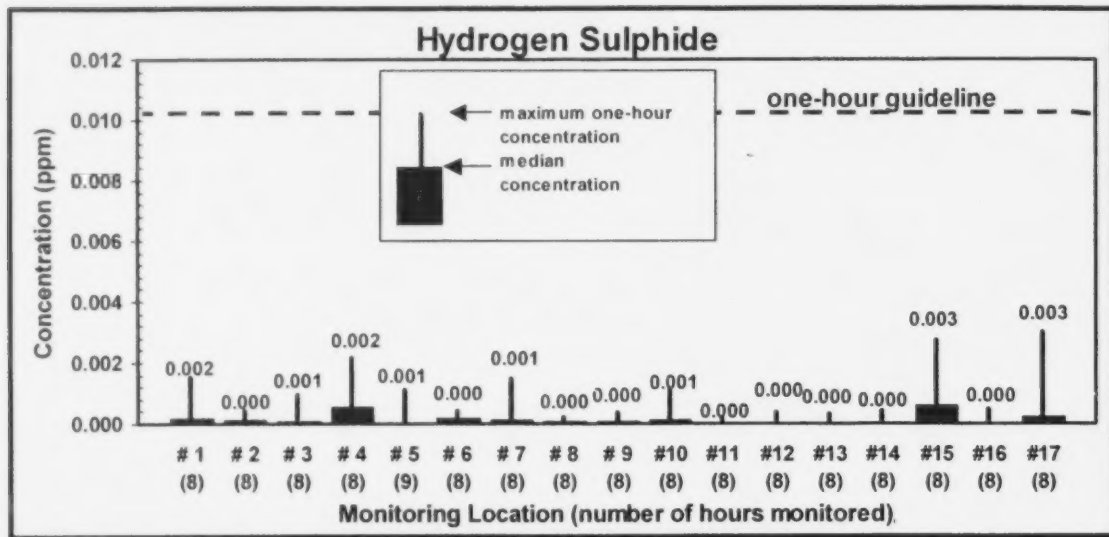


Figure 8: One-hour *median* and *maximum* concentrations for hydrogen sulphide.

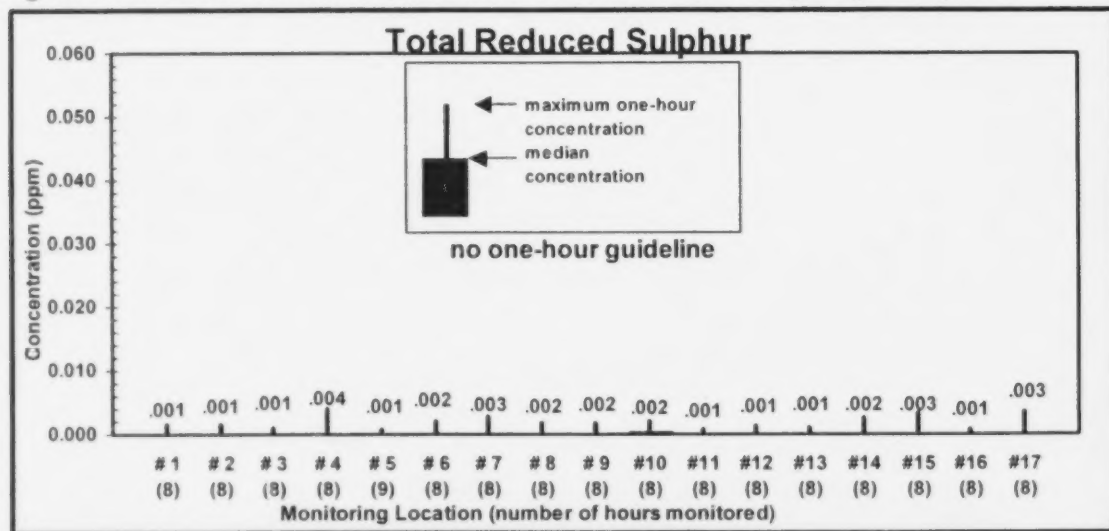


Figure 9: One-hour *median* and *maximum* concentrations for total reduced sulphur.

Oxides of Nitrogen (NO₂, NO and NO_x)

Maximum one-hour concentration recorded during survey	One-hour AAAQ guideline
NO ₂ = 0.051 ppm	0.212 ppm
NO = 0.164 ppm	no guideline
NO _x = 0.212 ppm	no guideline

Oxides of nitrogen (NO_x) are the total of nitrogen dioxide (NO₂) and nitric oxide (NO). During high temperature combustion - as in the burning of natural gas, coal, oil and gasoline - atmospheric nitrogen may combine with molecular oxygen to form NO. NO is colourless and odourless. Most NO in the ambient air is oxidized to form NO₂. NO₂ is a reddish-brown gas with a pungent odour. The major source of NO_x in urban areas is vehicle emissions. Processes associated with the oil and gas industry, power plants and cement plants also emit NO_x into the atmosphere. The primary sources of NO_x in the Fort Saskatchewan/Redwater area are likely vehicle and industrial emissions.

None of the NO₂ concentrations exceeded the one-hour Alberta ambient air quality (AAAQ) guideline of 0.212 ppm. One-hour concentrations ranged from less than 0.001 ppm to a maximum of 0.164 ppm for nitric

oxide (NO), 0.212 ppm for oxides of nitrogen (NO_x), and 0.051 ppm for nitrogen dioxide (NO₂); which represents 24 per cent of the one-hour guideline. The median concentration was 0.003 ppm for NO, 0.007 ppm for NO_x, and 0.004-ppm for NO₂. Please refer to Tables 5 and 6, page 24, for the data set.

The maximum NO₂ concentration (0.051 ppm) was recorded at Site # 1 on November 8, 2001. Maximum one-hour NO₂ concentrations typically range from 0.013 to 0.080 ppm at rural locations and from 0.065 to 0.150 ppm at urban locations in Alberta, based on 2001 data collected at permanent continuous monitoring stations. (See Table 8, page 26 for the data set.)

The median NO₂ concentration for the Fort Saskatchewan/Redwater area survey was 0.004 ppm. Median NO₂ levels collected at permanent continuous monitoring stations in rural locations in Alberta in 2001 ranged from less than 0.001 to 0.004 ppm. In Edmonton and Calgary, typical median NO₂ levels range from 0.013 to 0.025 ppm, based on 2001 data. Please refer to Table 7, page 25 for the data set.

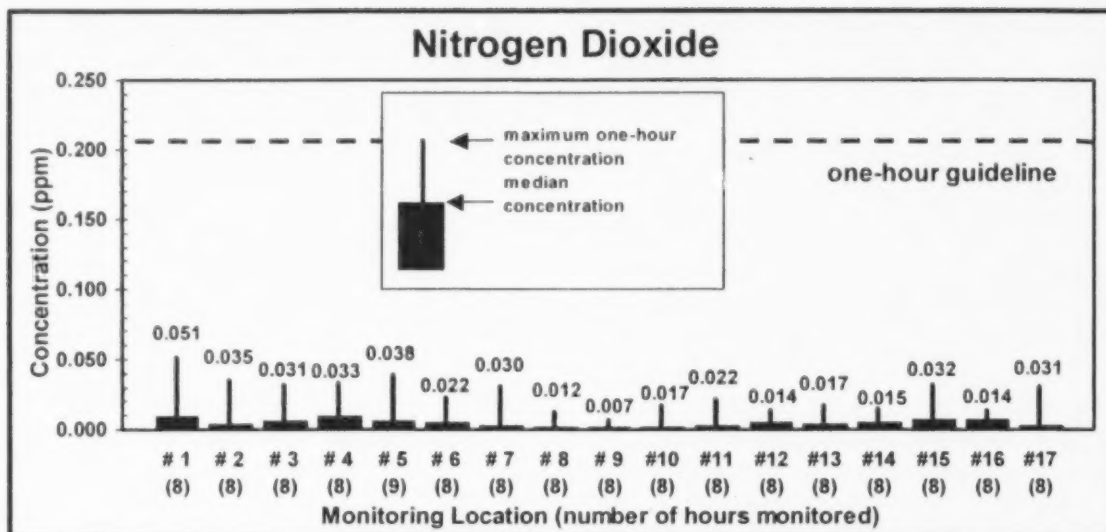


Figure 10: One-hour *median* and *maximum* concentrations for nitrogen dioxide.

Ozone (O₃)

Maximum one-hour concentration recorded during survey	One-hour AAAQ guideline
0.049 ppm	0.082 ppm

Ozone in the lower atmosphere is produced by the reaction of oxides of nitrogen and volatile organic compounds (VOC's) in the presence of sunlight. Transport of naturally occurring O₃ from the upper atmosphere to ground level contributes to ground level O₃ concentrations. Transport from the upper atmosphere is likely the dominant ozone producing process in the fall, winter and early spring seasons in Alberta. O₃ concentrations are generally lower in urban centres due to the destruction of O₃ by nitric oxide (NO), which results from combustion processes.

None of the O₃ concentrations measured exceeded the one-hour Alberta ambient air quality (AAAQ) guideline of 0.082 ppm. One-hour concentrations of ozone (O₃) ranged from 0.001 ppm to 0.049 ppm; which represents 60% of the one-hour guideline for O₃. The median O₃ concentration for the survey was 0.029 ppm. O₃ concentrations in the Fort Saskatchewan/Redwater area survey were generally highest in the afternoon during the

spring and summer season. These daily and seasonal variations are in line with findings at other locations in Alberta. Please refer to Tables 5 and 6, page 24 for the complete data set.

The maximum one-hour O₃ concentration of 0.049 ppm was recorded in the afternoon on May 23, 2001 at Site # 1. Higher O₃ levels are often observed in the afternoon due to the O₃ formation process, which requires the presence of sunlight. Increased volatilisation of VOCs resulting from warmer temperatures and increased vertical mixing of the atmosphere can contribute to an increase in O₃ levels later in the day. Typical maximum O₃ levels at permanent continuous monitoring stations in Alberta range from about 0.055 (Fort Chipewyan) to 0.080 ppm (Tomahawk) based on 2001 data. Please refer to Table 8, page 26, for the data set.

The median O₃ concentration for the Fort Saskatchewan/Redwater area survey was 0.029 ppm. Typical median O₃ levels at permanent continuous monitoring stations in Alberta range from 0.020 ppm (Fort McKay) to 0.043 ppm (Steeper) based on 2001 data. Please refer to Table 7, page 25, for the data set.

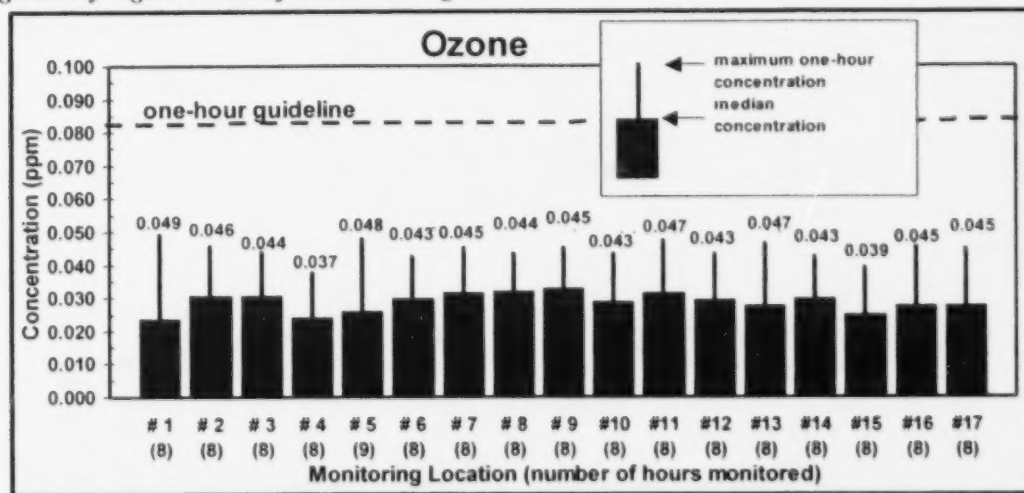


Figure 11: One-hour median and maximum concentrations for ozone.

Particulate Matter (TSP, PM₁₀ and PM_{2.5})

Maximum one-hour concentration recorded during survey	One-hour AAAQ guideline
TSP = 547 µg/m ³	no guideline
PM ₁₀ = 323 µg/m ³	no guideline
PM _{2.5} = 24 µg/m ³	no guideline

Air pollutants are not necessarily in a gaseous form. Tiny particles of solid material or liquid droplets, defined collectively as particulate matter (PM), are also present in the atmosphere. Total suspended particulates (TSP) refer to all particles up to 500 microns in diameter (a human hair is about 100 microns in diameter) and are important primarily from a nuisance perspective. Particles less than or equal to 10 micrometres in aerodynamic diameter (PM₁₀) can be inhaled, while smaller particles, less than or equal to 2.5 micrometres in aerodynamic diameter (PM_{2.5}), can penetrate deep into the lungs. Sources of coarse particulate (TSP, PM₁₀) include windblown dust, resuspended road dust, agricultural dust (e.g. during harvest), smoke from forest fires and recreational wood burning, vehicle emissions, brake and tire wear, and industrial emissions. Fine particles (PM_{2.5}) are found in the atmosphere because of combustion processes and condensation from sources such as vehicles, industrial facilities and wood burning. PM_{2.5} are also formed as a result of reactions of gaseous chemicals in the air. Particulate matter levels will vary depending on wind speed, precipitation and snow cover.

One-hour concentrations of PM ranged from less than 1 µg/m³ to 24 µg/m³ for PM_{2.5}, 323 µg/m³ for PM₁₀, and 547 µg/m³ for TSP. There are no one-hour guidelines in Alberta for particulate matter. The median concentration was 3 µg/m³ for PM_{2.5}, 22 µg/m³ for PM₁₀, and 39 µg/m³ for TSP. Guidelines do exist for 24

hour concentrations: the 24-hour guideline for TSP is 100 µg/m³, and the proposed 24-hour Canada-wide Standard (CWS) for PM_{2.5} is 30 µg/m³ over a 24 hour averaging time, based on the 98th percentile ambient measurement annually averaged over 3 consecutive years. Alberta Environment has estimated that the CWS is equivalent to a one-hour concentration of approximately 80 µg/m³ based on Calgary and Edmonton data. PM_{2.5} concentrations measured during the survey were well below 80 µg/m³, however levels of TSP and PM₁₀ were high at times. Please refer to Tables 5 and 6, page 24, for the data set.

The maximum one-hour TSP, PM₁₀ and PM_{2.5} concentrations were 547, 323 and 24 µg/m³. This level was detected at Site #5 on November 7.

The maximum one-hour TSP concentration in the survey area was 547 µg/m³. Maximum TSP levels from other MAML surveys ranged from 52 µg/m³ (Caroline/Sundre area 1997/1998) to 2305 µg/m³ (County of Grande Prairie 1998/1999).

The maximum one-hour PM₁₀ concentration in the survey area was 323 µg/m³. Maximum levels of PM₁₀ from other MAML surveys ranged from 43 µg/m³ (Caroline/Sundre area 1997/1998) to 1287 µg/m³ (County of Grande Prairie 1998/1999).

The maximum one-hour PM_{2.5} concentration in the survey area was 24 µg/m³. Maximum levels of PM_{2.5} ranged from 12 µg/m³ (City of Medicine Hat 1998/1999) to 294 µg/m³ (City of Lethbridge 1998/1999) in other MAML surveys. Please refer to Table 8, page 26, for the dataset.

Levels of large particulates (TSP, PM₁₀) were high during this survey, especially during the spring and fall. Maximum particulate concentrations were measured at Site # 5 on November 7, 2001. There was a visible haze in the area. Concentrations of oxides of nitrogen, hydrocarbons and PAH were also comparatively high. A likely

major source of large particulates was resuspended road dust from traffic near the monitoring sites. Vehicle emissions and industrial combustions processes were likely contributors to fine PM concentrations.

Median TSP concentrations in the survey area were $39 \mu\text{g}/\text{m}^3$. Median TSP levels from other MAML surveys ranged from $4 \mu\text{g}/\text{m}^3$ (Caroline/Sundre area 1997/1998) to $74 \mu\text{g}/\text{m}^3$ (Bow Corridor 1999/2000).

Median PM_{10} concentrations in the survey area were $22 \mu\text{g}/\text{m}^3$. Median levels of PM_{10}

from other MAML surveys ranged from $3 \mu\text{g}/\text{m}^3$ (Caroline/Sundre area 1997/1998) to $40 \mu\text{g}/\text{m}^3$ (Bow Corridor 1999/2000).

Median $\text{PM}_{2.5}$ concentrations in the survey area were $3 \mu\text{g}/\text{m}^3$. Median $\text{PM}_{2.5}$ levels in other MAML surveys ranged from less than $1 \mu\text{g}/\text{m}^3$ (Caroline/Sundre area 1997/1998) to $4 \mu\text{g}/\text{m}^3$ (Bow Corridor 1999/2000 and Whitecourt 2001). Please refer to Table 7, page 25, for the complete data set.

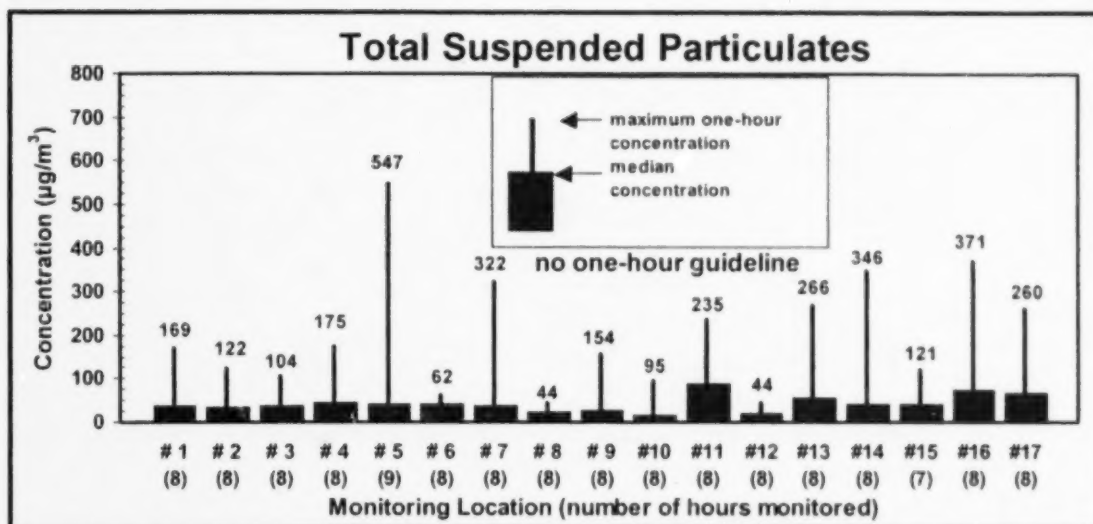


Figure 12: One-hour median and maximum concentrations for TSP.

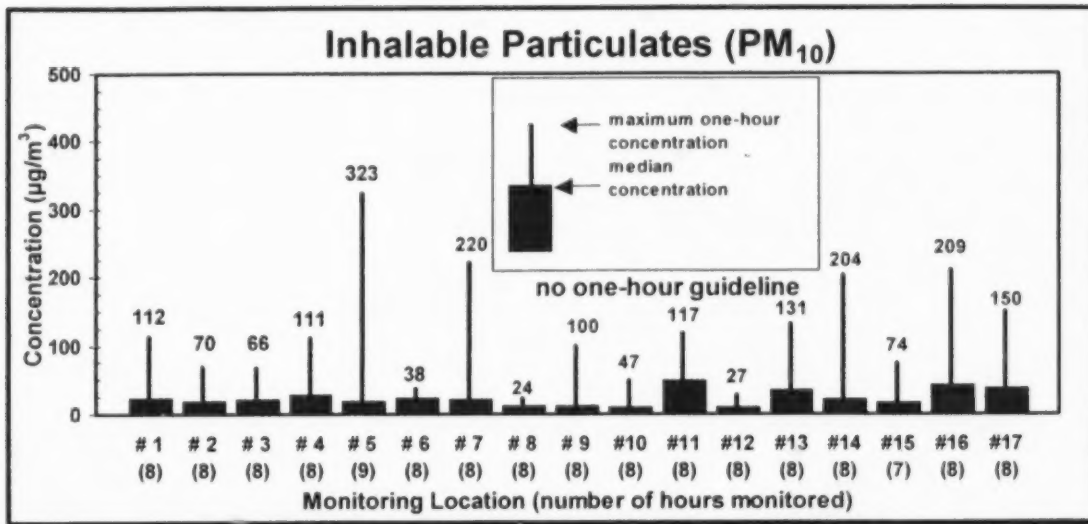


Figure 13: One-hour *median* and *maximum* concentrations for PM₁₀.

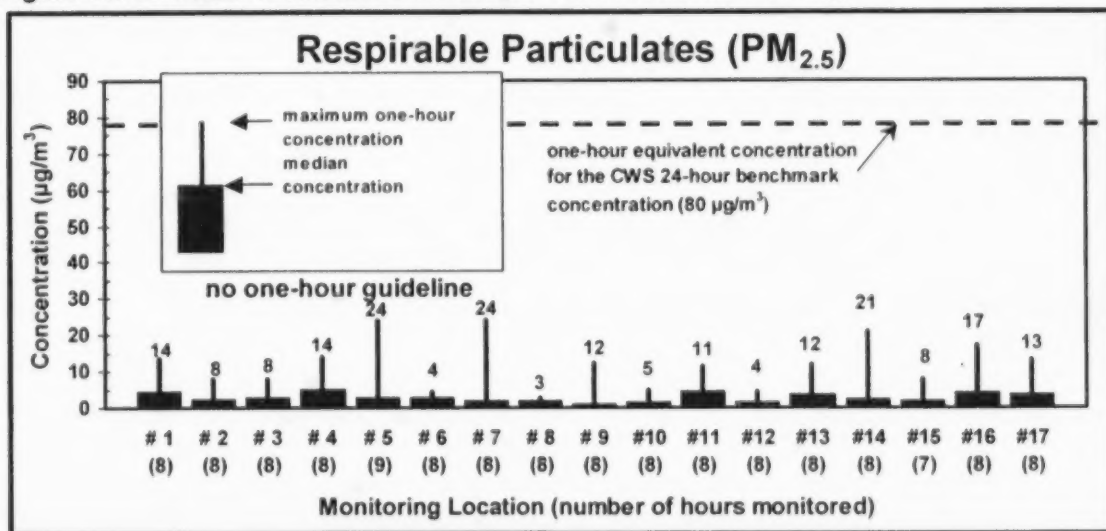


Figure 14: One-hour *median* and *maximum* concentrations for PM_{2.5}.

Polycyclic Aromatic Hydrocarbons (PAHs)

Maximum one-hour concentration recorded during survey	One-hour AAAQ guideline
70 ng/m ³	no guideline

Polycyclic aromatic hydrocarbons (PAHs) are a class of chemicals that are formed during the incomplete combustion of gasoline, diesel, oil, coal, wood, garbage or other organic substances. Tobacco smoke and charbroiled meats are common sources of PAHs. Other outdoor PAH sources include vehicle emissions, wood smoke from fireplaces, smoke from forest fires and industrial emissions. There are more than 100 different PAHs with varying levels of toxicity. PAHs occur in the atmosphere in the vapour phase or attached to dust particles. The PAH monitoring instrument aboard the MAML analyzes only particulate bound PAHs.

One-hour concentrations of polycyclic aromatic hydrocarbons (PAH) ranged from less than 3.0 ng/m³ (nanograms per cubic metre) to 70 ng/m³. The median concentration was 1 ng/m³. Alberta does not have a one-hour guideline for PAH. Please refer to Tables 5 and 6, page 24, for the data set.

The maximum one-hour PAH concentration of 70 ng/m³ was recorded at Site # 16 on November 15, 2001. Maximum PAH levels measured during previous air quality surveys in Alberta ranged from 11 ng/m³ in the Lethbridge area (1998/1999) to 36 ng/m³ in the Whitecourt/Swan Hills (2001) area. PAH levels detected were likely due to vehicle and industrial emissions. Please refer to Table 8, page 26, for the data set.

The median PAH concentration for the Fort Saskatchewan/Redwater area survey was less than 3 ng/m³. In comparison, median PAH levels measured during previous MAML air quality surveys in Alberta ranged from less than 3 ng/m³ to 5 ng/m³ in the City of Medicine Hat 1998/1999. Please refer to Table 7, page 25, for the data set.

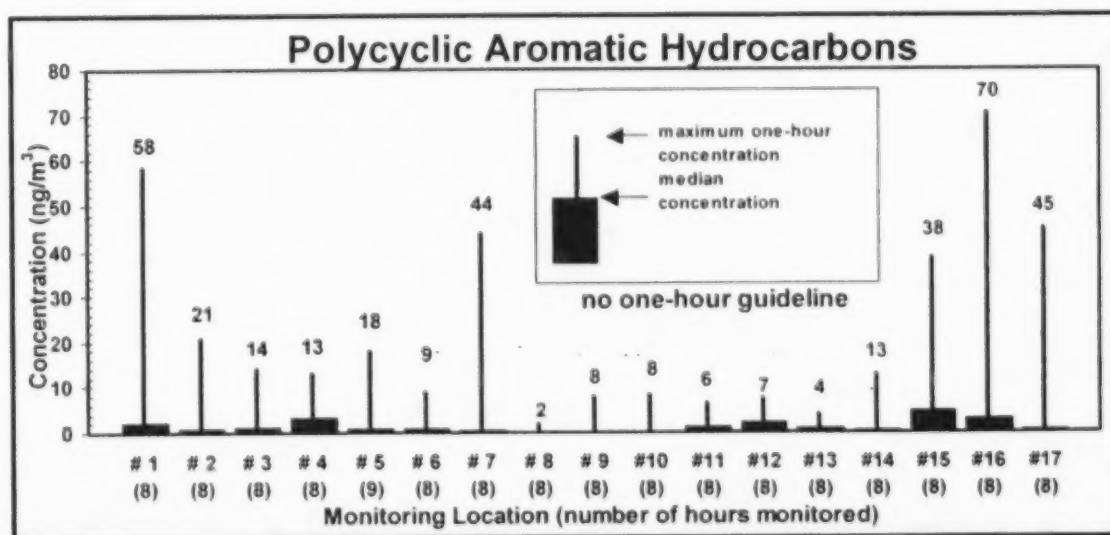


Figure 15: One-hour median and maximum concentrations for PAH.

Sulphur Dioxide (SO₂)

Maximum one-hour concentration recorded during survey	One-hour AAAQ guideline
0.022 ppm	0.172 ppm

Sulphur dioxide (SO₂) is a colourless gas with a pungent odour. In Alberta, it is estimated that 45% of SO₂ emissions are produced by natural gas processing plants while oil sands and power plants produce about 26% and 21% of SO₂ emissions, respectively⁶. Other sources include gas plant flares, oil refineries, pulp and paper mills and fertilizer plants.

None of the SO₂ concentrations measured exceeded the one-hour Alberta ambient air quality (AAAQ) guideline of 0.172 ppm. One-hour average concentrations of sulphur dioxide (SO₂) in the survey area ranged from less than 0.0006 ppm to a maximum of 0.022 ppm; which represents 13% of the one-hour guideline. The median SO₂ concentration was 0.001 ppm. Please refer to Tables 5 and 6, page 24 for the data set.

The maximum one-hour concentration of 0.022 ppm was measured at Site # 14 on Lamoureux Drive, 1 kilometre south of Highway 15, on the west side of the North Saskatchewan River on February 27, 2002. Winds were light from the east increasing in speed over the hour. Emissions from nearby industrial facilities likely contributed to SO₂ concentrations at this location.

Maximum one-hour concentrations from other MAML surveys ranged from 0.004 ppm in the Lethbridge area survey (1998/1999), to 0.092 ppm during the Bow Corridor survey (1999/2000). Maximum one-hour SO₂ concentrations in 2001 at permanent monitoring stations in Alberta ranged from 0.006 ppm (Steeper in west-central Alberta) to 0.231 ppm (Buffalo Viewpoint - north of Fort McMurray). Please refer to Table 8, page 26 for the data set.

The median SO₂ concentration was 0.001 ppm. In comparison, median SO₂ concentrations from previous MAML surveys in Alberta ranged from less than 0.0006 ppm to 0.004 ppm in the Whitecourt/Swan Hills area (2001). Please refer to Table 7, page 25 for the data set.

⁶ Environment Canada. 1998. 1995 Criteria Air Contaminant Emissions Inventory Summaries. Pollution Data Branch, Environment Canada.

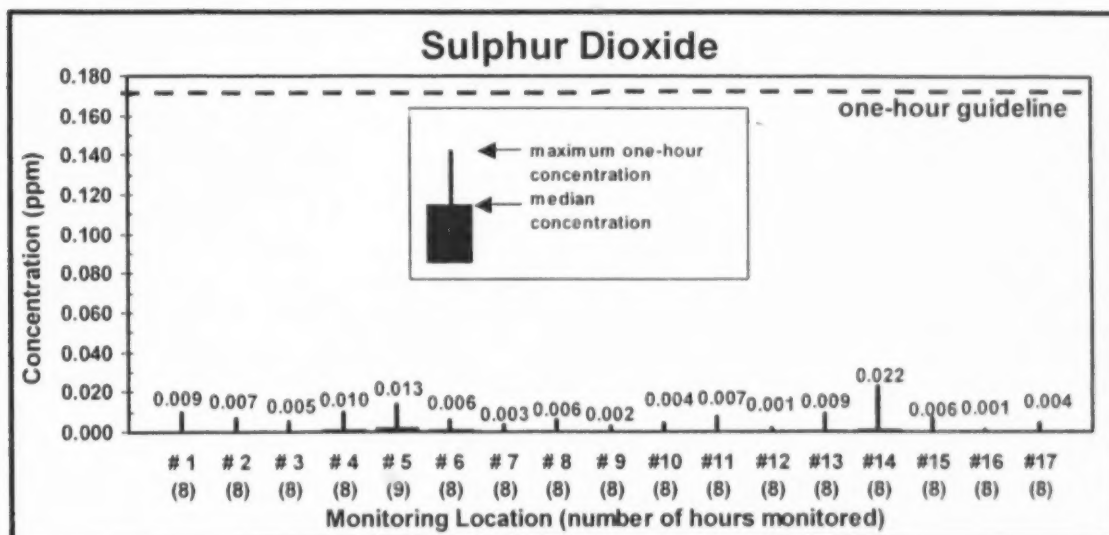


Figure 16: One-hour *median* and *maximum* concentrations for sulphur dioxide.

Volatile Organic Compounds (VOCs)

Volatile organic compounds (VOCs) include a large group of chemicals containing carbon and hydrogen atoms that can participate in atmospheric photochemical reactions. They can vaporize or convert into a gas phase without any chemical change (volatility). VOCs can also react with oxides of nitrogen (NO_x) under the influence of sunlight to produce a mixture of more than 100 air pollutants including ozone (O_3), a health hazard and major contributor to smog. Some VOCs also act as heat-trapping gases and some are capable of absorbing infrared light, and therefore can contribute to the greenhouse effect. They are important because they can present a health risk to humans, animals and vegetation.

Major sources of VOCs in the outdoor environment include vehicle emissions, gasoline stations and gasoline storage tanks, petroleum and chemical industries, and natural gas combustion. Other sources of VOCs include the evaporation of solvents as well as leaking valves, flanges, pumps and compressors at industrial facilities. VOCs are also contained in incinerator and flare stack emissions associated with the oil and gas industry.

Air Quality Guidelines for VOCs

Alberta does not have ambient one-hour air quality guidelines for all of the 153 VOCs analyzed for the Fort Saskatchewan/Redwater survey. However, there are ambient one-hour air quality guidelines for benzene, styrene, and vinyl chloride. The data was also compared to Ontario's half-hour Point of Impingement Limits, Ontario Ambient Air Quality Criteria and low and high odor threshold ranges, where applicable.

Monitoring Method

A total of 12 VOC samples were collected at the following three locations (please refer to Figure 2 for a map of the sampling locations).

- Site # 4 (Fence line between Dow Chemical and Sherritt Gordon) – six samples;
- Site # 5 (Shell Scotford) – five samples;
- Site # 6 (Agrium Redwater) – one sample.

The samplers were deployed for one-hour periods downwind of industrial facilities when odours were noticed or when comparatively high hydrocarbon levels were detected by the MAML.

The one-hour samples were collected to allow for comparison with Alberta's one-hour guideline for benzene, Ontario's Point of Impingement Limits and Air Quality Standards, and applicable odour thresholds (Please refer to Tables 17, page 36).

VOC samples were collected using 6 litre SilcoSteel canisters. Samples were analyzed for 153 VOCs. Environment Canada Environmental Technology Centre in Ottawa performed the sample preparation and analysis.

Results

Concentrations of all compounds were well below applicable guidelines and odor thresholds. Twelve samples were collected and were then analyzed for 153 VOC compounds. Of the 153 compounds measured, 137 were detected.

Comparing all locations sampled during this survey, the highest concentrations of VOC's were detected downwind of Site # 5 (Shell Scotford) on November 7, 2001. At this time winds were light from the southwest. A one-hour sample was collected from 12:23 to 1:24 p.m. During this sampling period, 62

compounds were measured at their highest concentration.

Overall, monitoring at Site #5 resulted in the highest concentrations measured for 113 compounds for the entire survey. Please refer to Table 17 for the data set.

Data Collected by the Mobile Air Monitoring Laboratory

Table 5: Median one-hour air pollutant concentrations at each monitoring site for the Fort Saskatchewan/Redwater area survey.

Site (# of hours monitored)	NH ₃	CO	CH ₄	RHC	THC	H ₂ S	NO	NO ₂	NO _x	O ₃	PM ₁₀	PM _{2.5}	TSP	PAH	SO ₂	TRS
	ppm	ppm	ppm		ppm	ppm	ppm			ppm	µg/m ³			ng/m ³	ppm	ppm
Site # 1 (8)	0.001	0.3	2.0	0.2	2.2	BD	0.008	0.010	0.018	0.024	26	5	41	BD	BD	BD
Site # 2 (8)	BD	0.3	2.0	0.1	2.0	BD	0.003	0.005	0.007	0.031	21	3	36	BD	BD	BD
Site # 3 (8)	0.002	0.3	2.0	0.0	2.1	BD	0.004	0.007	0.010	0.031	23	3	40	BD	0.001	BD
Site # 4 (8)	0.108	0.3	2.2	0.1	2.2	BD	0.014	0.010	0.023	0.024	30	5	47	3	0.002	BD
Site # 5 (9)	0.001	0.2	2.2	0.0	2.2	BD	0.005	0.007	0.012	0.026	22	3	42	BD	0.003	BD
Site # 6 (8)	0.008	0.2	2.1	0.1	2.2	BD	0.002	0.005	0.009	0.030	25	3	43	BD	0.002	BD
Site # 7 (8)	BD	0.2	2.0	0.1	2.1	BD	0.002	0.003	0.004	0.032	22	2	40	BD	BD	BD
Site # 8 (8)	BD	0.2	2.1	0.1	2.1	BD	0.002	0.002	0.003	0.032	14	2	27	BD	0.001	BD
Site # 9 (8)	BD	0.2	2.1	0.0	2.1	BD	0.001	0.002	0.002	0.033	14	1	28	BD	0.001	BD
Site # 10 (8)	BD	0.3	2.0	0.1	2.1	BD	0.002	0.002	0.003	0.029	13	2	20	BD	0.001	BD
Site # 11 (8)	0.001	0.3	2.1	0.0	2.1	BD	0.002	0.003	0.003	0.032	51	5	89	BD	BD	BD
Site # 12 (8)	BD	0.3	1.8	0.1	1.9	BD	0.005	0.005	0.012	0.029	13	2	23	BD	BD	BD
Site # 13 (8)	0.001	0.3	2.1	0.0	2.1	BD	0.001	0.005	0.006	0.028	36	4	59	BD	BD	BD
Site # 14 (8)	0.001	0.3	2.1	0.1	2.2	BD	0.002	0.006	0.008	0.030	23	3	42	BD	0.002	BD
Site # 15 (8)	0.001	0.4	2.2	0.1	2.3	0.001	0.007	0.008	0.015	0.025	24	2	33	5	0.001	BD
Site # 16 (8)	BD	0.2	2.0	0.1	2.1	BD	0.004	0.008	0.011	0.028	44	5	77	3	BD	BD
Site # 17 (8)	0.002	0.3	2.1	0.1	2.2	BD	0.002	0.003	0.006	0.028	39	4	69	BD	0.001	BD
Overall Median	0.001	0.3	2.1	0.1	2.1	BD	0.003	0.004	0.007	0.029	22	3	39	BD	0.001	BD

ppm - parts per million

ng/m³ - nanograms per cubic metre of air

µg/m³ - micrograms per cubic metre of air

BD - indicates below the detection limit of the instrument

Table 6: Maximum one-hour air pollutant concentrations at each monitoring site for the Fort Saskatchewan/Redwater area survey.

Site (# of hours monitored)	NH ₃	CO	CH ₄	RHC	THC	H ₂ S	NO	NO ₂	NO _x	O ₃	PM ₁₀	PM _{2.5}	TSP	PAH	SO ₂	TRS
	ppm	ppm	ppm		ppm	ppm	ppm			ppm	µg/m ³			ng/m ³	ppm	ppm
Site # 1 (8)	0.007	1.9	2.2	0.5	2.6	0.002	0.164	0.051	0.212	0.049	112	14	169	58	0.009	0.001
Site # 2 (8)	0.007	0.6	2.1	0.2	2.3	BD	0.030	0.035	0.065	0.046	70	8	122	21	0.007	0.001
Site # 3 (8)	0.016	0.6	2.5	0.1	2.7	0.001	0.014	0.031	0.045	0.044	66	8	104	14	0.005	0.001
Site # 4 (8)	0.557	0.4	2.4	0.4	2.7	0.002	0.056	0.033	0.080	0.037	111	14	175	13	0.010	0.004
Site # 5 (9)	0.015	0.6	2.7	0.1	2.8	0.001	0.081	0.038	0.120	0.048	323	24	547	18	0.013	0.001
Site # 6 (8)	0.044	0.5	2.4	0.1	2.4	BD	0.031	0.022	0.052	0.043	38	4	62	9	0.006	0.002
Site # 7 (8)	0.004	2.2	2.5	0.5	3.1	0.001	0.140	0.030	0.169	0.045	220	24	322	44	0.003	0.003
Site # 8 (8)	0.006	0.3	2.3	0.1	2.3	BD	0.007	0.012	0.017	0.044	24	3	44	BD	0.006	0.002
Site # 9 (8)	0.006	0.5	2.4	0.1	2.4	BD	0.004	0.007	0.010	0.045	100	12	154	8	0.002	0.002
Site # 10 (8)	0.004	0.5	2.5	0.1	2.5	0.001	0.017	0.017	0.034	0.043	47	5	95	8	0.004	0.002
Site # 11 (8)	0.017	0.6	2.4	0.1	2.4	BD	0.018	0.022	0.040	0.047	117	11	235	6	0.007	0.001
Site # 12 (8)	0.004	0.4	2.1	0.5	2.4	BD	0.018	0.014	0.032	0.043	27	4	44	7	0.001	0.001
Site # 13 (8)	0.004	0.5	2.6	0.1	2.7	BD	0.011	0.017	0.029	0.047	131	12	266	4	0.009	0.001
Site # 14 (8)	0.010	0.3	2.3	0.2	2.4	BD	0.011	0.015	0.027	0.043	204	21	346	13	0.022	0.002
Site # 15 (8)	0.005	0.7	2.6	0.3	2.6	0.003	0.083	0.032	0.111	0.039	74	8	121	38	0.006	0.003
Site # 16 (8)	0.008	0.3	2.5	0.2	2.6	BD	0.047	0.014	0.061	0.045	209	17	371	70	0.001	0.001
Site # 17 (8)	0.005	1.3	3.6	0.2	3.6	0.003	0.123	0.031	0.154	0.045	150	13	260	45	0.004	0.003
Overall maximum	0.557	2.2	3.6	0.5	3.6	0.003	0.164	0.051	0.212	0.049	323	24	547	70	0.022	0.004
one-hour guideline	2.000	13.0	n/a		0.010	n/a	0.210	n/a	0.082		n/a			0.172	n/a	

ppm - parts per million

ng/m³ - nanograms per cubic metre of air

n/a - No one hour guideline.

µg/m³ - micrograms per cubic metre of air

BD - indicates below the detection limit of the instrument

Table 7: Median one-hour concentrations for selected air quality parameters in Alberta*

Air Quality Station	Station or Survey Type	Monitoring Period	NH ₃ ppm	CO ppm	CH ₄ ppm	RHC ppm	THC ppm	H ₂ S ppm	NO ₂ ppm	O ₃ ppm	PM ₁₀ µg/m ³	PM _{2.5} µg/m ³	TSP µg/m ³	PAHs µg/m ³	SO ₂ ppm	TRS ppm
Fort Saskatchewan/Redwater ¹	mobile survey	May 2001 to Mar. 2002	0.001	0.3	2.1	0.1	2.1	BD	0.004	0.029	22	3	39	BD	0.001	BD
Cold Lake/Bonnyville/Elk Point ¹	mobile survey	Mar. 2001 to Feb. 2002	BD	0.2	1.9	0.1	2.1	BD	0.003	0.031	10	2	16	BD	BD	0.001
Whitecourt/Swan Hills/Shiningbank Lake ¹	mobile survey	Mar. 2001 to June 2001	0.001	0.2	2.0	0.3	2.3	BD	0.005	0.027	29	4	47	BD	0.004	0.001
Bow Corridor ¹	mobile survey	Dec. 1999 to Sep. 2000	0.001	0.2	1.8	0.1	1.9	BD	0.007	0.030	40	4	74	4	0.001	0.001
County of Grande Prairie ¹	mobile survey	Dec. 1998 to Oct. 1999	0.001	0.2	1.7	0.2	2.0	BD	0.002	0.036	9	2	14	BD	0.001	BD
Caroline/Sundre area ¹	mobile survey	Apr. 1997 to Apr. 1998	n/a	0.3	1.8	0.2	2.1	BD	0.009	0.042	3	BD	4	n/a	0.002	BD
City of Lethbridge ¹	mobile survey	Sep. 1998 to Jul. 1999	0.005	0.2	1.6	0.2	1.9	BD	0.003	0.046	11	2	17	BD	BD	BD
City of Medicine Hat ¹	mobile survey	May 1998 to Jan. 1999	0.003	0.4	1.8	0.2	2.1	BD	0.009	0.031	11	2	16	5	0.001	BD
Lethbridge area (Picture Butte, Sterling) ¹	mobile survey	Sep. 1998 to Jul. 1999	0.075	0.2	1.8	0.2	2.1	0.001	0.002	0.044	24	3	42	BD	0.001	0.002
Permanent Continuous Monitoring Stations																
Beaverlodge ³	rural	Jan. to Dec. 2001	n/a	n/a	n/a	n/a	n/a	n/a	0.002	0.027	n/a	n/a	n/a	n/a	BD	n/a
Calgary Central ²	urban	Jan. to Dec. 2001	n/a	0.5	n/a	n/a	2.0	n/a	0.025	0.014	19	8	n/a	n/a	n/a	n/a
Calgary East ²	urban	Jan. to Dec. 2001	n/a	0.5	n/a	n/a	2.1	0.001	0.022	0.015	n/a	n/a	n/a	n/a	0.002	n/a
Calgary Northwest ²	urban	Jan. to Dec. 2001	n/a	0.3	n/a	n/a	2.0	n/a	0.013	0.024	n/a	n/a	n/a	n/a	n/a	n/a
Edmonton Central ²	urban	Jan. to Dec. 2001	n/a	0.5	n/a	n/a	2.0	n/a	0.023	0.014	n/a	7	n/a	n/a	n/a	n/a
Edmonton East ²	urban	Jan. to Dec. 2001	n/a	0.3	n/a	n/a	2.2	BD	0.015	0.021	n/a	8	n/a	n/a	0.002	n/a
Edmonton Northwest ³	urban	Jan. to Dec. 2001	n/a	0.5	n/a	n/a	2.2	n/a	0.020	0.016	19	10	n/a	n/a	n/a	n/a
Fort Saskatchewan ²	small urban	Jan. to Dec. 2001	0.002	0.3	n/a	n/a	1.9	BD	0.009	0.021	n/a	n/a	n/a	n/a	0.001	n/a
Red Deer ²	small urban	Jan. to Dec. 2001	n/a	0.3	n/a	n/a	2.1	BD	0.010	0.019	n/a	7	n/a	n/a	BD	n/a
Buffalo Viewpoint ³	industrial	Jan. to Dec. 2001	n/a	n/a	n/a	n/a	1.9	BD	n/a	n/a	n/a	n/a	n/a	n/a	BD	n/a
Fort Chipewyan ³	rural	Jan. to Dec. 2001	n/a	n/a	n/a	n/a	n/a	n/a	BD	0.029	n/a	4	n/a	n/a	BD	n/a
Fort McKay ³	rural	Jan. to Dec. 2001	n/a	n/a	n/a	n/a	1.8	n/a	0.003	0.020	n/a	5	n/a	n/a	BD	BD
Fort McMurray (Athabasca Valley) ³	small urban	Jan. to Dec. 2001	n/a	0.2	n/a	n/a	1.9	n/a	0.007	0.016	n/a	5	n/a	n/a	BD	BD
Fort McMurray (Paricha McInnes) ³	small urban	Jan. to Dec. 2001	n/a	n/a	n/a	n/a	1.9	n/a	0.003	0.021	n/a	6	n/a	n/a	BD	BD
Mannix ⁵	industrial	Jan. to Dec. 2001	n/a	n/a	n/a	n/a	1.8	BD	n/a	n/a	n/a	n/a	n/a	n/a	0.001	n/a
Mildred Lake ³	industrial	Jan. to Dec. 2001	n/a	n/a	n/a	n/a	2.0	BD	n/a	n/a	n/a	n/a	n/a	n/a	0.001	n/a
Carrot Creek ⁶	rural	Jan. to Sept. 2001	n/a	n/a	n/a	n/a	n/a	n/a	0.004	0.034	n/a	n/a	n/a	n/a	0.001	n/a
Hightower Ridge ⁴	background	Jan. to Sept. 2001	n/a	n/a	n/a	n/a	n/a	n/a	BD	0.048	5	BD	n/a	n/a	BD	n/a
Steeper ⁴	rural	Jan. to Sept. 2001	n/a	n/a	n/a	n/a	n/a	n/a	0.001	0.043	7	n/a	n/a	n/a	BD	n/a
Tomahawk ⁴	rural	Jan. to Sept. 2001	n/a	n/a	n/a	n/a	n/a	n/a	0.003	0.034	11	2	n/a	n/a	0.001	n/a
Violet Grove ⁴	rural	Jan. to Sept. 2001	n/a	n/a	n/a	n/a	1.8	n/a	0.002	0.037	n/a	n/a	n/a	n/a	0.001	n/a
Sherwood Park ³	small urban	Jan. to Dec. 2001	n/a	n/a	n/a	n/a	2.2	BD	n/a	n/a	n/a	n/a	n/a	n/a	0.002	n/a
Caroline ⁶	rural	Aug. to Dec. 2001	n/a	n/a	1.9	n/a	2.0	BD	0.002	0.035	n/a	n/a	n/a	n/a	0.001	BD

¹ Mobile survey conducted by Alberta Environment.

² Station operated by Alberta Environment.

³ Station operated by the Wood Buffalo Environmental Association

⁴ Station operated by the West Central Airshed Society (data from Oct to Dec 2001 not available).

⁵ Station operated by the Strathcona Industrial Association.

⁶ Station operated by the Parkland Airshed Management Association.

n/a Parameter not monitored or data not available.

BD - Indicates below the detection limit of the instrument

* Data is from the Alberta Ambient Air Data Management System (<http://www.casadata.org>).

Table 8: Maximum one-hour concentrations for selected air quality parameters in Alberta*

Air Quality Station	Station or Survey Type	Monitoring Period	NH ₃ ppm	CO ppm	CH ₄ ppm	RHC ppm	THC ppm	H ₂ S ppm	NO ₂ ppm	O ₃ ppm	PM ₁₀ µg/m ³	PM _{2.5} µg/m ³	TSP µg/m ³	PAHs ng/m ³	SO ₂ ppm	TRS ppm
Fort Saskatchewan/Redwater ¹	mobile survey	May 2001 to Mar. 2002	0.557	2.2	3.6	0.5	3.6	0.003	0.051	0.049	323	24	547	70	0.022	0.004
Cold Lake/Bonnyville/Elk Point ¹	mobile survey	Mar. 2001 to Feb. 2002	0.005	1.4	4.6	7.1	9.7	0.054	0.014	0.047	1188	72	2281	14	0.017	0.056
Whitecourt/Swan Hills/Shiningbank Lake ¹	mobile survey	Nov. 2000 to June 2001	0.013	0.7	2.5	2.5	4.3	0.003	0.030	0.054	441	43	946	113	0.046	0.005
Bow Corridor ¹	mobile survey	Dec. 1999 to Sep. 2000	0.034	1.1	2.2	6.6	7.8	0.002	0.031	0.056	1094	60	2082	36	0.092	0.004
County of Grande Prairie ¹	mobile survey	Dec. 1998 to Oct. 1999	0.030	1.0	6.4	29.4	32.4	0.009	0.061	0.064	1287	101	2305	35	0.043	0.010
Caroline/Sundre area ¹	mobile survey	Apr. 1997 to Apr. 1998	n/a	0.9	2.6	0.7	2.9	0.008	0.040	0.059	43	17	52	n/a	0.043	0.008
City of Lethbridge ¹	mobile survey	Sep. 1998 to Jul. 1999	0.020	2.4	1.9	0.4	2.2	0.003	0.016	0.062	363	294	405	21	0.007	0.001
City of Medicine Hat ¹	mobile survey	May 1998 to Jul. 1999	0.027	2.8	2.3	0.4	2.6	0.004	0.080	0.062	135	12	213	35	0.029	0.001
Lethbridge area (Picture Butte, Sterling) ¹	mobile survey	Sep. 1998 to Jul. 1999	1.364	1.2	7.1	1.6	9.5	0.054	0.013	0.059	298	32	490	11	0.004	0.054
Permanent Continuous Monitoring Stations																
Beaverlodge ³	rural	Jan. to Dec. 2001	n/a	n/a	n/a	n/a	n/a	n/a	0.028	0.068	n/a	n/a	n/a	n/a	n/a	n/a
Calgary Central ²	urban	Jan. to Dec. 2001	n/a	9.7	n/a	n/a	4.1	n/a	0.150	0.061	262	60	n/a	n/a	n/a	n/a
Calgary East ²	urban	Jan. to Dec. 2001	n/a	10.1	n/a	n/a	5.1	0.038	0.092	0.068	n/a	n/a	n/a	n/a	n/a	n/a
Calgary Northwest ²	urban	Jan. to Dec. 2001	n/a	6.3	n/a	n/a	3.5	n/a	0.065	0.073	n/a	n/a	n/a	n/a	n/a	n/a
Edmonton Central ²	urban	Jan. to Dec. 2001	n/a	5.4	n/a	n/a	4.8	n/a	0.086	0.062	n/a	275	n/a	n/a	n/a	n/a
Edmonton East ²	urban	Jan. to Dec. 2001	n/a	2.8	n/a	n/a	25.0	0.022	0.084	0.083	n/a	276	n/a	n/a	n/a	n/a
Edmonton Northwest ²	urban	Jan. to Dec. 2001	n/a	11.2	n/a	n/a	6.5	n/a	0.104	0.071	391	261	n/a	n/a	n/a	n/a
Fort Saskatchewan ²	small urban	Jan. to Dec. 2001	0.041	5.1	n/a	n/a	5.5	0.005	0.077	0.080	n/a	83	n/a	n/a	0.022	n/a
Red Deer ²	small urban	Jan. to Dec. 2001	n/a	5.0	n/a	n/a	6.4	0.009	0.051	0.073	n/a	162	n/a	n/a	0.011	n/a
Buffalo Viewpoint ³	industrial	Jan. to Dec. 2001	n/a	n/a	n/a	n/a	11.8	0.012	n/a	n/a	n/a	n/a	n/a	n/a	0.231	n/a
Fort Chipewyan ³	rural	Jan. to Dec. 2001	n/a	n/a	n/a	n/a	n/a	n/a	0.024	0.055	n/a	58	n/a	n/a	0.025	n/a
Fort McKay ³	rural	Jan. to Dec. 2001	n/a	n/a	n/a	n/a	4.2	n/a	0.042	0.058	n/a	86	n/a	n/a	0.158	0.018
Fort McMurray (Athabasca Valley) ³	small urban	Jan. to Dec. 2001	n/a	5.8	n/a	n/a	5.8	n/a	0.062	0.062	n/a	267	n/a	n/a	0.071	0.003
Fort McMurray (Patricia McInnes) ³	small urban	Jan. to Dec. 2001	n/a	n/a	n/a	n/a	6.3	n/a	0.073	0.074	n/a	101	n/a	n/a	0.042	0.011
Mannix ³	industrial	Jan. to Dec. 2001	n/a	n/a	n/a	n/a	6.6	0.027	n/a	n/a	n/a	n/a	n/a	n/a	0.211	n/a
Mildred Lake ³	industrial	Jan. to Dec. 2001	n/a	n/a	n/a	n/a	6.9	0.022	n/a	n/a	n/a	n/a	n/a	n/a	0.136	n/a
Carrot Creek ⁴	rural	Jan. to Sept. 2001	n/a	n/a	n/a	n/a	n/a	n/a	0.059	0.077	n/a	n/a	n/a	n/a	0.019	n/a
Hightower Ridge ⁴	background	Jan. to Sept. 2001	n/a	n/a	n/a	n/a	n/a	n/a	0.015	0.081	31	36	n/a	n/a	0.018	n/a
Steeper ⁴	rural	Jan. to Sept. 2001	n/a	n/a	n/a	n/a	n/a	n/a	0.019	0.075	193	n/a	n/a	n/a	0.006	n/a
Tomahawk ⁴	rural	Jan. to Sept. 2001	n/a	n/a	n/a	n/a	n/a	n/a	0.039	0.080	187	56	n/a	n/a	0.029	n/a
Violet Grove ⁴	rural	Jan. to Sept. 2001	n/a	n/a	n/a	n/a	8.4	n/a	0.036	0.070	n/a	n/a	n/a	n/a	0.015	n/a
Sherwood Park ⁵	small urban	Jan. to Dec. 2001	n/a	n/a	n/a	n/a	8.8	0.012	n/a	n/a	n/a	n/a	n/a	n/a	0.043	n/a
Caroline ⁶	rural	Jan. to Dec. 2001	n/a	n/a	3.5	n/a	7.2	0.017	0.031	0.074	n/a	n/a	n/a	n/a	0.017	0.017

1 Mobile survey conducted by Alberta Environment.

2 Station operated by Alberta Environment.

3 Station operated by the Wood Buffalo Environmental Association

4 Station operated by the West Central Airshed Society (data from Oct to Dec 2001 not available).

5 Station operated by the Strathcona Industrial Association.

6 Station operated by the Parkland Airshed Management Association.

n/a Parameter not monitored or data not available.

BD - indicates below the detection limit of the instrument

* Data is from the Alberta Ambient Air Data Management System (<http://www.casadata.org>).

Table 9: One-hour average air pollutant concentrations in the Fort Saskatchewan/Redwater area survey
(Spring - May 16 to 18, 22 and 23, 2001).

Date	Monitoring Location	Time (MST)	NH ₃ ppm	CO ppm	CH ₄ ppm	RHC ppm	THC ppm	H ₂ S ppm	NO ppm	NO ₂ ppm	NO _x ppm	O ₃ ppm	PM ₁₀ µg/m ³	PM _{2.5} µg/m ³	TSP µg/m ³	PAH ng/m ³	SO ₂ ppm	TRS ppm
16-May-01	Site #15	8:08 a.m. to 9:08 a.m.	0.002	0.65	2.2	BD	2.1	BD	0.009	0.008	0.017	0.027	36	5	66	10.3	BD	BD
	Site #17	9:21 a.m. to 10:21 a.m.	0.003	0.57	2.1	0.1	2.2	BD	0.004	0.003	0.008	0.039	39	5	64	BD	BD	BD
	Site #3	10:36 a.m. to 11:36 a.m.	0.009	0.59	2.0	0.1	2.1	BD	0.005	0.008	0.014	0.038	24	3	40	BD	0.001	BD
	Site #4	12:04 p.m. to 1:04 p.m.	0.154	0.37	2.1	0.1	2.1	BD	0.019	0.011	0.029	0.036	42	8	66	BD	0.002	BD
	Site #5	1:42 p.m. to 2:44 p.m.	0.011	0.33	2.1	0.0	2.1	BD	0.002	BD	0.002	0.048	58	5	115	BD	BD	BD
17-May-01	Site #11	3:09 p.m. to 4:09 p.m.	0.003	0.35	2.1	0.0	2.2	BD	0.002	0.001	0.003	0.047	46	5	99	BD	BD	BD
	Site #13	4:26 p.m. to 5:26 p.m.	0.003	0.30	2.1	0.0	2.1	BD	0.001	BD	0.002	0.047	34	4	69	BD	BD	BD
	Site #10	10:02 a.m. to 11:02 a.m.	BD	0.24	2.0	0.1	2.1	BD	0.002	0.001	0.003	0.043	10	1	19	BD	0.001	BD
	Site #8	11:21 a.m. to 12:21 p.m.	BD	0.22	2.0	0.1	2.1	BD	0.002	0.001	0.002	0.044	15	2	30	BD	0.001	BD
	Site #9	12:33 p.m. to 1:33 p.m.	BD	0.49	2.0	0.1	2.1	BD	0.004	0.003	0.003	0.045	33	4	61	BD	BD	BD
18-May-01	Site #7	1:59 p.m. to 2:59 p.m.	BD	0.42	1.9	0.1	2.0	BD	0.004	0.003	0.004	0.045	39	4	72	BD	BD	BD
	Site #6	3:32 p.m. to 4:32 p.m.	0.007	0.55	1.9	0.1	2.1	BD	0.001	0.003	0.004	0.043	32	4	52	BD	0.001	BD
	Site #2	5:41 p.m. to 6:41 p.m.	BD	0.57	1.9	0.1	1.9	BD	0.002	0.001	0.002	0.043	13	2	23	BD	BD	BD
	Site #1	7:02 p.m. to 8:02 p.m.	BD	0.25	1.9	0.2	2.1	BD	0.001	0.001	0.001	0.042	13	2	24	BD	BD	BD
	Site #13	8:29 a.m. to 9:28 a.m.	BD	0.13	2.0	0.1	2.1	BD	BD	BD	BD	0.040	131	12	266	BD	BD	BD
22-May-01	Site #11	9:46 a.m. to 10:46 a.m.	BD	BD	2.0	0.1	2.1	BD	BD	0.002	0.001	0.041	117	11	235	BD	BD	BD
	Site #4	11:17 a.m. to 12:17 p.m.	0.557	0.29	2.2	0.2	2.4	0.002	0.056	0.023	0.080	0.023	100	14	175	BD	0.010	0.004
	Site #3	12:28 p.m. to 1:27 p.m.	0.016	0.20	2.1	0.1	2.1	BD	0.001	0.002	0.003	0.044	31	3	63	BD	0.001	0.001
	Site #14	3:30 p.m. to 4:30 p.m.	0.002	0.28	2.1	0.1	2.2	BD	BD	0.002	0.001	0.043	17	2	31	BD	0.002	0.002
	Site #12	4:56 p.m. to 5:56 p.m.	0.001	0.27	1.8	0.5	2.4	BD	0.003	0.003	0.003	0.042	26	3	42	BD	0.001	0.001
23-May-01	Site #6	8:54 a.m. to 9:54 a.m.	0.008	0.19	2.0	0.1	2.2	BD	0.008	0.010	0.018	0.031	31	4	54	BD	0.006	BD
	Site #7	10:23 a.m. to 11:23 a.m.	0.002	BD	1.9	0.1	2.0	BD	0.002	0.002	0.004	0.043	27	3	50	BD	0.002	BD
	Site #9	11:42 a.m. to 12:42 p.m.	BD	0.39	2.0	0.1	2.1	BD	0.003	0.001	0.003	0.039	100	12	154	BD	0.002	BD
	Site #8	1:02 p.m. to 2:02 p.m.	BD	0.30	1.9	0.1	2.0	BD	0.004	0.003	0.004	0.039	13	2	23	BD	0.001	BD
	Site #10	2:27 p.m. to 3:27 p.m.	BD	0.34	1.9	0.1	2.1	BD	0.004	0.002	0.004	0.041	17	2	27	BD	BD	BD
23-May-01	Site #17	4:32 p.m. to 5:32 p.m.	BD	0.32	2.1	0.1	2.2	BD	0.003	0.003	0.004	0.045	50	5	92	BD	0.002	BD
	Site #15	5:45 p.m. to 6:45 p.m.	BD	0.45	2.1	0.1	2.3	BD	0.007	0.011	0.017	0.039	24	3	45	BD	0.006	BD
	Site #16	6:58 a.m. to 7:58 a.m.	0.006	0.27	2.5	0.1	2.6	BD	0.011	0.012	0.022	0.018	60	8	94	3.5	BD	BD
	Site #5	9:04 a.m. to 10:04 a.m.	0.005	0.13	2.3	0.1	2.4	BD	0.002	0.002	0.005	0.036	39	5	62	BD	0.003	BD
	Site #14	11:01 a.m. to 12:01 p.m.	0.010	0.19	2.3	0.2	2.4	BD	0.005	0.008	0.011	0.038	204	21	346	BD	0.002	BD
23-May-01	Site #2	12:08 p.m. to 1:08 p.m.	0.007	0.18	2.1	0.2	2.3	BD	0.006	0.006	0.009	0.046	70	8	122	BD	0.001	BD
	Site #1	1:24 p.m. to 2:24 p.m.	0.007	0.17	2.0	0.2	2.2	BD	0.003	0.004	0.006	0.049	55	6	101	BD	BD	BD
	Site #16	2:52 p.m. to 3:52 p.m.	0.008	0.13	1.9	0.2	2.2	BD	0.006	0.008	0.011	0.045	42	6	65	BD	BD	BD
	Site #12	4:50 p.m. to 5:50 p.m.	0.004	0.17	1.7	0.2	1.9	BD	BD	BD	0.002	0.003	27	4	44	BD	BD	BD
	one-hour guideline		2.0	13.0	n/a	n/a	n/a	0.010	n/a	0.212	n/a	0.082	n/a	n/a	n/a	n/a	0.172	n/a

no data - Indicates the analyzer was not operational for the indicated time period.
n/a - No one hour guideline.

- CO - carbon monoxide
O₃ - ozone
THC - total hydrocarbons
CH₄ - methane
RHC - reactive hydrocarbons
SO₂ - sulphur dioxide
NO_x - nitrogen oxide
NO₂ - nitrogen dioxide
NH₃ - ammonia
TRS - total reduced sulphur
H₂S - hydrogen sulphide
PAH - polycyclic aromatic hydrocarbons
TSP - total suspended particulates
PM₁₀ - inhalable particulates
PM_{2.5} - respirable particulates

Table 10: One-hour average air pollutant concentrations in the Fort Saskatchewan/Redwater area survey
(Summer - July 18 to 20, 26 and 27, 2001).

Date	Monitoring Location	Time (MST)	NH ₃ ppm	CO ppm	CH ₄ ppm	RHC ppm	THC ppm	H ₂ S ppm	NO ppm	NO ₂ ppm	NO _x ppm	O ₃ ppm	PM ₁₀ µg/m ³	PM _{2.5} µg/m ³	TSP µg/m ³	PAH ng/m ³	SO ₂ ppm	TRS ppm
18-Jul-01	Site #15	8:35 a.m. to 9:35 a.m.	BD	0.2	2.1	0.0	2.1	BD	0.005	0.008	0.0131	0.022	13	1.2	23	6	0.001	BD
	Site #17	9:49 a.m. to 10:49 a.m.	BD	0.2	2.1	0.0	2.1	BD	0.002	0.003	0.006	0.025	39	2.8	75	BD	0.001	BD
	Site #3	11:04 a.m. to 12:04 p.m.	BD	0.2	2.1	0.1	2.2	BD	0.006	0.012	0.016	0.020	23	2.4	40	BD	0.005	0.001
	Site #4	12:32 p.m. to 1:32 p.m.	0.062	0.2	2.2	0.0	2.2	BD	0.008	0.010	0.017	0.019	15	1.9	24	4	0.002	BD
	Site #5	2:04 p.m. to 3:04 p.m.	0.015	0.3	2.2	0.0	2.2	BD	0.005	0.007	0.012	0.022	22	2.3	42	BD	0.003	BD
19-Jul-01	Site #11	3:30 p.m. to 4:30 p.m.	0.004	0.2	2.1	BD	2.1	BD	0.0013	0.003	0.004	0.027	9	1.1	15	BD	0.002	0.001
	Site #13	4:45 p.m. to 5:45 p.m.	0.002	0.3	2.2	BD	2.0	BD	0.003	0.006	0.008	0.023	16	1.2	27	BD	0.002	0.001
	Site #10	9:56 a.m. to 10:56 a.m.	BD	0.2	2.0	0.0	2.0	BD	0.001	BD	0.030	11	1.1	17	BD	BD	BD	BD
	Site #8	11:15 a.m. to 12:15 p.m.	BD	0.1	1.9	0.1	2.0	BD	BD	BD	0.034	10	1.0	21	BD	BD	BD	BD
	Site #9	12:36 p.m. to 1:36 p.m.	BD	0.2	2.0	0.0	2.1	BD	BD	0.001	BD	0.035	10	1.0	16	BD	BD	BD
20-Jul-01	Site #7	1:58 p.m. to 2:58 p.m.	BD	0.2	1.9	0.1	2.0	BD	BD	0.001	BD	0.035	12	1.2	21	BD	BD	BD
	Site #6	3:34 p.m. to 4:34 p.m.	BD	0.2	2.0	0.1	2.1	BD	BD	0.002	BD	0.034	18	1.8	31	BD	BD	BD
	Site #2	5:20 p.m. to 6:20 p.m.	BD	0.2	1.9	0.1	2.0	BD	BD	0.003	BD	0.036	41	3.4	74	BD	BD	BD
	Site #1	6:36 p.m. to 7:36 p.m.	BD	0.2	1.9	0.0	2.0	BD	BD	0.002	BD	0.032	11	1.4	18	BD	BD	BD
	Site #13	9:18 a.m. to 10:18 a.m.	BD	0.2	2.0	0.1	2.0	BD	0.001	0.003	0.002	0.033	38	4.0	63	BD	BD	BD
26-Jul-01	Site #11	10:37 a.m. to 11:37 a.m.	BD	0.2	2.0	0.1	2.0	BD	0.002	0.003	0.002	0.037	7	1.0	14	BD	BD	BD
	Site #4	12:13 p.m. to 1:13 p.m.	BD	0.2	2.2	0.4	2.3	BD	0.002	0.006	0.005	0.037	22	2.3	38	BD	0.002	BD
	Site #3	1:26 p.m. to 2:26 p.m.	BD	0.2	1.9	0.1	2.0	BD	0.002	0.006	0.005	0.037	16	1.6	30	BD	0.001	BD
	Site #14	2:41 p.m. to 3:41 p.m.	BD	0.2	2.0	0.1	2.1	BD	BD	0.003	0.002	0.028	15	1.9	25	BD	0.002	BD
	Site #16	3:55 p.m. to 4:55 p.m.	BD	0.2	1.9	0.1	2.0	BD	0.003	0.009	0.011	0.021	46	3.3	89	3	0.001	BD
27-Jul-01	Site #12	5:16 p.m. to 6:16 p.m.	BD	0.2	1.8	0.1	1.9	BD	0.005	0.008	0.012	0.024	12	1.2	24	6	BD	BD
	Site #7	9:21 a.m. to 10:21 a.m.	BD	0.2	2.2	0.0	2.1	BD	0.001	0.003	0.003	0.022	11	1.5	14	BD	BD	0.001
	Site #9	10:39 a.m. to 11:39 a.m.	BD	0.1	2.2	0.1	2.2	BD	0.001	0.002	0.002	0.022	9	1.1	17	8	BD	0.001
	Site #8	11:54 a.m. to 12:54 p.m.	BD	0.2	2.1	0.0	2.0	BD	0.002	0.002	0.002	0.030	6	1.0	9	BD	BD	0.001
	Site #10	1:10 p.m. to 2:10 p.m.	BD	0.3	2.1	0.0	2.0	BD	BD	0.002	0.001	0.028	9	1.1	17	BD	BD	0.002
28-Jul-01	Site #6	2:44 p.m. to 3:44 p.m.	BD	0.4	2.3	0.1	2.2	BD	0.007	0.007	0.013	0.025	20	2.4	35	3	0.002	0.002
	Site #17	4:15 p.m. to 5:15 p.m.	0.003	0.3	2.1	0.0	2.1	BD	0.001	0.002	0.002	0.032	22	2.2	41	BD	BD	0.001
	Site #15	5:31 p.m. to 6:31 p.m.	0.002	0.4	2.3	0.1	2.3	0.003	0.008	0.006	0.013	0.024	no data			4	BD	0.003
	Site #1	8:26 a.m. to 9:26 a.m.	BD	0.5	2.1	0.5	2.6	0.001	0.021	0.017	0.040	0.012	24	3.6	39	9	0.009	BD
	Site #2	9:39 a.m. to 10:39 a.m.	BD	0.3	2.0	0.1	2.1	BD	0.003	0.005	0.009	0.021	13	2.0	21	BD	0.007	0.001
29-Jul-01	Site #14	10:44 a.m. to 11:44 a.m.	0.001	0.3	2.0	0.2	2.2	BD	0.002	0.004	0.006	0.029	19	2.1	38	BD	0.007	0.002
	Site #5	12:35 p.m. to 1:35 p.m.	BD	0.2	1.9	0.1	2.0	BD	BD	0.004	0.004	0.040	21	2.0	39	BD	0.003	BD
	Site #16	2:06 p.m. to 3:06 p.m.	BD	0.2	1.9	0.1	2.0	BD	BD	BD	0.041	10	1.1	17	BD	BD	0.001	BD
	Site #12	3:25 p.m. to 4:25 p.m.	BD	0.3	1.8	0.1	1.9	BD	0.006	0.006	0.013	0.032	13	1.3	23	7	0.001	0.001
	one-hour guideline		2.0	13.0	n/a			0.010	n/a	0.212	n/a	0.082	n/a			n/a	0.172	n/a

no data - Indicates the analyzer was not operational for the indicated time period.
n/a - No one hour guideline.

ppm - parts per million
BD - indicates below the detection limit of the instrument

List of Air Quality Parameters
 CO - carbon monoxide
 O₃ - ozone
 THC - total hydrocarbons
 CH₄ - methane
 NH₃ - ammonia
 TSP - total suspended particulates
 PM₁₀ - inhalable particulates
 PM_{2.5} - respirable particulates
 SO₂ - reactive hydrocarbons
 SO_x - sulphur dioxide
 NO - nitric oxide
 NO₂ - nitrogen dioxide
 NO_x - total oxides of nitrogen
 H₂S - hydrogen sulphide
 TSP - total suspended particulates
 PM₁₀ - inhalable particulates
 PM_{2.5} - respirable particulates

Table 11: One-hour average air pollutant concentrations in the Fort Saskatchewan/Redwater area survey (Fall - November 7 to 9, 13 and 15, 2001).

Date	Monitoring Location	Time (MST)	NH ₃ ppm	CO ppm	CH ₄ ppm	RHC ppm	THC ppm	H ₂ S ppm	NO ppm	NO ₂ ppm	NO _x ppm	O ₃ ppm	PM ₁₀ µg/m ³	PM _{2.5} µg/m ³	TSP µg/m ³	PAH ng/m ³	SO ₂ ppm	TRS ppm
7-Nov-01	Site #13	9:41 a.m. to 10:40 a.m.	BD	0.5	2.4	0.04	2.45	BD	0.011	0.017	0.029	0.010	16	3	27	4	0.009	BD
	Site #11	10:56 a.m. to 11:55 a.m.	BD	0.5	2.4	0.05	2.45	BD	0.018	0.022	0.040	0.010	19	3	29	6	0.007	BD
	Site #5	12:20 p.m. to 1:20 p.m.	0.006	0.6	2.7	0.05	2.71	0.001	0.081	0.038	0.120	0.005	323	24	547	18	0.007	BD
	Site #4	1:55 p.m. to 2:55 p.m.	0.212	0.2	2.2	0.05	2.22	0.001	0.022	0.021	0.045	0.015	29	4	46	4	0.004	BD
	Site #15	3:51 p.m. to 4:51 p.m.	0.005	0.4	1.8	0.05	1.89	0.002	0.067	0.032	0.099	0.005	24	3	44	23	0.003	BD
8-Nov-01	Site #3	5:06 p.m. to 6:06 p.m.	0.003	0.6	2.0	0.05	2.02	0.001	0.014	0.031	0.045	0.004	36	4	70	14	0.002	BD
	Site #17	6:19 p.m. to 7:17 p.m.	0.004	0.3	2.0	0.05	2.03	0.001	BD	0.018	0.019	0.010	82	8	121	BD	0.001	BD
	Site #10	10:08 a.m. to 11:08 a.m.	0.002	0.4	1.9	0.08	1.99	BD	0.002	0.008	0.009	0.018	47	4	95	8	0.004	0.002
	Site #8	11:35 a.m. to 12:35 p.m.	0.003	BD	1.8	0.05	1.87	BD	0.001	0.004	0.004	0.029	18	2	35	BD	0.006	0.002
	Site #9	12:47 p.m. to 1:47 p.m.	0.001	BD	1.8	0.05	1.87	BD	BD	0.003	0.002	0.032	18	1	37	BD	0.002	0.001
9-Nov-01	Site #7	2:08 p.m. to 3:08 p.m.	BD	BD	1.8	0.05	1.85	BD	0.001	0.009	0.011	0.026	38	4	67	3	BD	0.001
	Site #6	3:24 p.m. to 4:24 p.m.	0.044	BD	1.9	0.05	1.97	BD	0.002	0.013	0.015	0.017	38	4	62	BD	0.002	0.001
	Site #2	5:22 p.m. to 6:15 p.m.	0.005	0.6	1.8	0.05	1.88	BD	0.030	0.035	0.065	BD	65	7	102	17	0.004	BD
	Site #1	6:35 p.m. to 7:35 p.m.	0.004	1.9	2.0	0.50	2.52	0.002	0.164	0.051	0.212	0.002	112	14	169	58	0.005	0.001
	Site #12	10:25 a.m. to 11:25 a.m.	BD	0.3	1.9	0.06	1.88	BD	0.006	0.012	0.018	0.027	11	1	19	BD	BD	BD
13-Nov-01	Site #16	11:43 a.m. to 12:43 p.m.	BD	0.3	2.0	0.05	1.98	BD	0.004	0.010	0.015	0.028	130	8	288	5	BD	BD
	Site #3	12:57 p.m. to 1:57 p.m.	BD	0.3	2.0	0.05	1.99	BD	0.003	0.005	0.007	0.032	18	2	36	BD	BD	BD
	Site #14	2:20 p.m. to 3:20 p.m.	BD	0.2	2.1	0.05	2.08	BD	0.002	0.015	0.017	0.022	167	11	339	9	BD	BD
	Site #4	3:56 p.m. to 4:56 p.m.	0.178	0.4	2.2	0.05	2.23	0.001	0.019	0.033	0.052	0.004	111	13	168	13	BD	BD
	Site #11	5:26 p.m. to 6:26 p.m.	0.017	0.6	2.1	0.11	2.25	BD	0.013	0.019	0.030	0.012	116	10	200	6	0.001	BD
15-Nov-01	Site #13	6:27 p.m. to 7:27 p.m.	0.004	0.3	2.0	0.05	2.06	BD	0.001	0.014	0.015	0.013	62	7	92	4	BD	BD
	Site #15	9:07 a.m. to 10:07 a.m.	0.002	0.7	2.5	0.09	2.57	0.001	0.083	0.028	0.111	0.003	74	8	121	38	0.004	0.002
	Site #17	10:22 a.m. to 11:22 a.m.	0.005	1.3	3.6	0.06	3.63	0.003	0.123	0.031	0.154	0.004	150	13	260	45	0.004	0.003
	Site #6	11:55 a.m. to 12:55 p.m.	0.008	0.5	2.4	0.05	2.41	BD	0.031	0.022	0.052	0.009	29	4	50	9	0.004	0.002
	Site #9	1:40 p.m. to 2:40 p.m.	0.006	0.3	2.2	0.05	2.25	BD	0.003	0.007	0.010	0.022	8	1	14	BD	0.002	0.002
15-Nov-01	Site #8	2:50 p.m. to 3:49 p.m.	0.006	0.3	2.1	0.07	2.19	BD	0.007	0.012	0.017	0.015	24	3	44	BD	0.002	0.001
	Site #10	4:05 p.m. to 5:05 p.m.	0.004	0.5	2.5	0.08	2.53	BD	0.017	0.017	0.034	0.003	40	5	63	7	0.001	0.002
	Site #7	5:33 p.m. to 6:33 p.m.	0.004	2.2	2.5	0.55	3.08	0.001	0.140	0.030	0.169	0.003	220	24	322	44	0.003	0.003
	Site #12	9:41 a.m. to 10:41 a.m.	0.001	0.4	1.9	0.05	1.97	BD	0.009	0.004	0.013	0.011	21	3	36	BD	BD	0.001
	Site #16	11:15 a.m. to 12:15 p.m.	0.006	0.2	2.1	0.05	2.10	BD	0.047	0.014	0.061	0.008	209	17	371	70	BD	BD
15-Nov-01	Site #5	1:00 p.m. to 2:00 p.m.	BD	0.2	2.2	0.05	2.19	BD	0.005	0.007	0.012	0.011	13	2	20	BD	BD	BD
	Site #14	2:45 p.m. to 3:45 p.m.	0.005	0.3	2.3	0.07	2.31	BD	0.011	0.015	0.027	0.002	27	3	47	13	BD	BD
	Site #2	3:54 p.m. to 4:54 p.m.	0.007	0.6	2.0	0.05	2.04	BD	0.024	0.015	0.041	BD	21	2	34	21	BD	BD
15-Nov-01	Site #1	5:15 p.m. to 6:15 p.m.	0.006	0.8	1.8	0.05	1.99	BD	0.026	0.034	0.058	0.001	81	7	144	20	BD	0.001
	one-hour guideline		2.0	13.0	n/a	n/a	n/a	0.010	n/a	0.212	n/a	0.082	n/a	n/a	n/a	n/a	0.172	n/a

no data - Indicates the analyzer was not operational for the indicated time period.
n/a - No one hour guideline.

CO - carbon monoxide
O₃ - ozone
THC - total hydrocarbons
CH₄ - methane

RHC - reactive hydrocarbons
SO₂ - sulphur dioxide
NO - nitric oxide
NO₂ - nitrogen dioxide

PM₁₀ - total suspended particulates
PM_{2.5} - respirable particulates
PAH - polycyclic aromatic hydrocarbons

SO₂ - sulphur dioxide
NO - nitric oxide
NO₂ - nitrogen dioxide

PM₁₀ - total suspended particulates
PM_{2.5} - respirable particulates
PAH - polycyclic aromatic hydrocarbons

SO₂ - sulphur dioxide
NO - nitric oxide
NO₂ - nitrogen dioxide

Table 12: One-hour average air pollutant concentrations in the Fort Saskatchewan/Redwater area survey
(Winter - February 25 to 28, and March 1, 2002).

Date	Monitoring Location	Time (MST)		NH ₃ ppm	CO ppm	CH ₄ ppm	RHC ppm	THC ppm	H ₂ S ppm	NO ppm	NO ₂ ppm	NO _x ppm	O ₃ ppm	PM ₁₀ µg/m ³	PM _{2.5} µg/m ³	TSP µg/m ³	PAH ng/m ³	SO ₂ ppm	TRS ppm
25-Feb-02	Site #15	9:44 a.m. to 10:44 a.m.	BD	0.2	2.2	0.3	2.6	0.003	0.006	0.005	0.009	0.028	8	2	12	BD	BD	0.001	0.001
	Site #17	10:56 a.m. to 11:56 a.m.	BD	0.2	2.4	0.2	2.7	0.001	0.004	0.003	0.006	0.029	8	3	10	BD	BD	0.001	0.001
	Site #3	12:11 p.m. to 1:11 p.m.	BD	0.3	2.5	0.0	2.7	BD	0.003	0.004	0.006	0.030	21	3	40	BD	BD	0.001	0.001
	Site #4	1:22 p.m. to 2:22 p.m.	0.030	0.3	2.4	0.1	2.7	0.001	0.009	0.008	0.016	0.026	26	7	38	BD	0.001	0.001	0.001
	Site #5	2:50 p.m. to 3:50 p.m.	0.001	0.2	2.5	0.0	2.7	0.001	0.008	0.007	0.013	0.026	19	3	31	BD	0.001	0.001	0.001
26-Feb-02	Site #5	4:27 p.m. to 5:27 p.m.	BD	0.5	2.6	0.0	2.8	0.001	0.027	0.031	0.057	0.009	96	12	159	9	0.013	0.001	0.001
	Site #13	5:56 p.m. to 6:56 p.m.	BD	0.3	2.6	0.1	2.7	BD	0.003	0.015	0.018	0.016	39	10	55	BD	BD	BD	BD
	Site #10	10:34 a.m. to 11:34 a.m.	BD	0.2	2.4	0.1	2.4	0.001	0.003	0.004	0.006	0.027	14	3	20	BD	0.002	BD	BD
	Site #8	11:50 a.m. to 12:50 p.m.	BD	0.1	2.2	0.0	2.2	BD	BD	BD	0.001	0.036	11	2	17	BD	BD	BD	BD
	Site #9	1:02 p.m. to 2:02 p.m.	BD	0.1	2.2	0.0	2.2	BD	0.001	BD	0.001	0.039	6	1	7	BD	BD	BD	BD
27-Feb-02	Site #7	2:31 p.m. to 3:31 p.m.	BD	0.1	2.1	0.0	2.1	BD	BD	BD	0.001	0.039	6	2	8	BD	BD	BD	BD
	Site #6	4:02 p.m. to 5:02 p.m.	0.018	0.2	2.2	0.0	2.2	BD	0.001	0.004	0.005	0.036	12	2	19	BD	BD	BD	BD
	Site #11	5:25 p.m. to 6:25 p.m.	0.002	0.3	2.1	0.0	2.1	BD	0.006	0.008	0.017	0.029	56	8	80	4	BD	BD	BD
	Site #12	6:52 p.m. to 7:52 p.m.	BD	0.2	2.0	0.0	2.0	BD	BD	0.004	0.005	0.032	7	2	10	BD	BD	BD	BD
	Site #1	8:06 p.m. to 9:06 p.m.	BD	0.3	2.2	0.0	2.2	BD	BD	BD	BD	0.035	4	2	5	BD	BD	BD	BD
28-Feb-02	Site #12	8:34 a.m. to 9:34 a.m.	BD	0.2	2.1	0.0	2.1	BD	BD	0.003	0.002	0.032	7	1	11	BD	0.001	BD	BD
	Site #13	10:05 a.m. to 11:05 a.m.	0.002	0.3	2.3	0.0	2.3	BD	0.001	0.003	0.005	0.033	17	2	31	BD	0.001	BD	BD
	Site #11	11:28 a.m. to 12:28 p.m.	BD	0.2	2.1	0.0	2.1	BD	0.001	0.002	0.002	0.035	56	5	101	BD	0.001	BD	BD
	Site #4	1:02 p.m. to 2:02 p.m.	0.001	0.2	2.2	0.0	2.2	BD	0.002	0.008	0.009	0.033	31	4	48	BD	0.002	BD	BD
	Site #3	2:21 p.m. to 3:21 p.m.	0.009	0.3	2.2	0.0	2.2	BD	0.005	0.014	0.019	0.026	66	8	104	4	0.003	BD	BD
1-Mar-02	Site #14	3:40 p.m. to 4:40 p.m.	0.001	0.3	2.3	0.0	2.3	BD	0.003	0.008	0.010	0.032	99	8	172	BD	0.022	BD	BD
	Site #16	4:57 p.m. to 5:57 p.m.	BD	0.2	2.1	0.0	2.1	BD	0.001	0.001	0.001	0.033	19	3	30	BD	BD	BD	BD
	Site #6	9:36 a.m. to 10:36 a.m.	BD	0.2	2.4	0.0	2.4	BD	0.002	0.003	0.003	0.029	14	2	21	BD	0.005	BD	BD
	Site #7	10:52 a.m. to 11:52 a.m.	BD	0.1	2.5	0.0	2.5	BD	0.004	0.004	0.007	0.029	18	2	30	BD	0.003	BD	BD
	Site #8	12:14 p.m. to 1:14 p.m.	BD	0.2	2.3	0.0	2.3	BD	0.003	0.003	0.004	0.031	21	3	32	BD	0.001	BD	BD
28-Feb-02	Site #9	1:28 p.m. to 2:28 p.m.	BD	0.2	2.4	0.0	2.4	BD	0.002	0.002	0.002	0.032	49	6	72	BD	0.002	BD	BD
	Site #10	2:51 p.m. to 3:51 p.m.	BD	0.3	2.3	0.0	2.3	BD	0.001	0.002	0.002	0.032	7	1	10	BD	BD	BD	BD
	Site #17	5:13 p.m. to 6:13 p.m.	BD	0.3	2.5	0.0	2.4	BD	BD	0.005	0.005	0.026	15	3	21	BD	BD	BD	BD
	Site #15	6:23 p.m. to 7:23 p.m.	BD	0.4	2.6	0.2	2.5	BD	0.001	0.003	0.003	0.028	11	2	19	BD	BD	BD	BD
	Site #12	9:36 a.m. to 10:36 a.m.	BD	0.3	1.7	0.0	1.7	BD	0.018	0.014	0.032	0.019	8	2	11	4	BD	BD	0.001
1-Mar-02	Site #16	10:53 a.m. to 11:53 a.m.	BD	0.3	2.0	0.0	2.0	BD	0.004	0.005	0.008	0.028	10	2	15	BD	BD	BD	0.001
	Site #5	12:34 p.m. to 1:34 p.m.	BD	0.1	2.0	0.0	2.0	BD	0.003	0.004	0.008	0.030	19	3	32	BD	0.001	BD	BD
	Site #14	2:03 p.m. to 3:03 p.m.	BD	0.2	2.1	0.0	2.0	BD	0.001	0.001	0.003	0.032	13	2	21	BD	BD	BD	BD
	Site #2	3:10 p.m. to 4:10 p.m.	BD	0.1	2.0	0.1	2.0	BD	0.002	0.002	0.004	0.030	20	3	37	BD	BD	BD	BD
	Site #1	4:24 p.m. to 5:24 p.m.	0.001	0.3	1.9	0.3	2.1	BD	0.013	0.018	0.030	0.015	27	6	43	5	0.006	BD	BD
one-hour guideline				2.0	13.0	n/a	n/a	n/a	0.010	n/a	0.212	n/a	0.082	n/a	n/a	n/a	n/a	0.172	n/a

no data - indicates the analyzer was not operational for the indicated time period
n/a - no one hour guideline

CO - carbon monoxide
O₃ - ozone
THC - total hydrocarbons
CH₄ - methane
RHC - reactive hydrocarbons
SO₂ - sulphur dioxide
NO - nitric oxide
NO₂ - nitrogen dioxide
NH₃ - ammonia
TRS - total reduced sulphur
H₂S - hydrogen sulphide
PM₁₀ - total suspended particulates
PM_{2.5} - respirable particulates
PAH - polycyclic aromatic hydrocarbons
TSP - total suspended particulates

Table 13: Meteorological Data and Field Notes for the Fort Saskatchewan/Redwater area survey
Spring (May 16 to 18, 22 and 23, 2001).

Date	Monitoring Location	Time (MST)	Temp °C	RH %	WSP km/h	WDR	Cloud %	Operator's Remarks
16-May-01	Site #15	8:08 a.m. to 9:08 a.m.	13	60	3	SW	40	Twp 534 & Hwy 21
	Site #17	9:21 a.m. to 10:21 a.m.	17	39	6	W	30	Dow Centennial fields @ Rge 231 & Twp 543. This is the Ft. Sask city limits.
	Site #3	10:36 a.m. to 11:36 a.m.	19	28	6	S	n/a	1 Blk W of 101 St on 100 Ave @ Jarvis Park in Ft. Sask.
	Site #4	12:04 p.m. to 1:04 p.m.	18	29	13	N	60	Junction of 99 Ave & 114 St (Tinecraft parking lot). 12:08 PM -Odours & NH ₃ readings. Set out canister #1 on N side of 99 Ave at the tracks. Sherritt fence line 100m N of canister location.
	Site #5	1:42 p.m. to 2:44 p.m.	19	29	10	NW	60	100m S of Twp 560 on Rge 220. W side of Shell Scottford
	Site #11	3:09 p.m. to 4:09 p.m.	18	31	12	NW	60	Bruderheim Arena
	Site #13	4:26 p.m. to 5:26 p.m.	18	30	13	N	80	52 St & 52 Ave in Lamont.
	Site #10	10:02 a.m. to 11:02 a.m.	15	27	18	W	10	5 St & 6 Ave. Thorhild Centennial Park.
	Site #8	11:21 a.m. to 12:21 p.m.	16	21	14	W	40	Sacred Heart Church in Egremont.
	Site #9	12:33 p.m. to 1:33 p.m.	17	20	19	W	40	Redwater River bridge on Twp Rd 584 1/2 way between Rge Rd 225 & Rge Rd 230.
	Site #7	1:59 p.m. to 2:59 p.m.	17	22	16	W	40	Redwater Lions park, 1 Blk N of Hwy 38.
	Site #6	3:32 p.m. to 4:32 p.m.	15	27	24	W	70	1km N of Twp Rd 562 on Rge Rd 213A. Agrum fertilizer plant. 3:34 PM - particulates from sand deposits in open field.
	Site #2	5:41 p.m. to 6:41 p.m.	15	28	25	W	80	Rge Rd 231 between Hwy 37 & Hwy 15.
	Site #1	7:02 p.m. to 8:02 p.m.	14	29	7	W	n/a	Manning Dr. 1 Blk N of 167 Ave.
	Site #13	8:29 a.m. to 9:28 a.m.	10	26	18	W	0	Lamont. Dust from strong winds.
	Site #11	9:46 a.m. to 10:46 a.m.	12	21	23	W	0	Bruderheim Centre. 50 St & 52 Ave.
18-May-01	Site #4	11:17 a.m. to 12:17 p.m.	15	17	19	W	0	Along 99 Ave. Move E & stop downwind of Sherritt. 11:19 AM -Set out canister #2.
	Site #3	12:28 p.m. to 1:27 p.m.	15	14	17	W	20	Ft. Sask. town centre.
	Site #14	3:30 p.m. to 4:30 p.m.	16	16	26	W	80	Along Lamoureux Dr. 1/2 km S of Hwy 15.
	Site #12	4:56 p.m. to 5:56 p.m.	14	17	21	NW	40	Rge Rd 212 and Hwy 11, Brookville Hall.
	Site #6	8:54 a.m. to 9:54 a.m.	18	35	10	SW	10	3.2km N of Twp Rd 564 on Rge Rd 213A.
	Site #7	10:23 a.m. to 11:23 a.m.	20	30	8	W	20	n/a
	Site #9	11:42 a.m. to 12:42 p.m.	22	28	11	W	30	Redwater River Valley.
	Site #8	1:02 p.m. to 2:02 p.m.	24	24	8	W	40	In front of church in Egremont.
22-May-01	Site #10	2:27 p.m. to 3:27 p.m.	23	24	14	W	10	5 St & 6 Ave in Thorhild.
	Site #17	4:32 p.m. to 5:32 p.m.	26	21	7	W	10	Dow Centennial Fields.
	Site #15	5:45 p.m. to 6:45 p.m.	27	21	5	S	n/a	Twp Rd 534 on Hwy 21. Akenide
	Site #16	6:58 a.m. to 7:58 a.m.	16	43	7	W	0	Twp Rd 540 & Hwy 21.
23-May-01	Site #5	9:04 a.m. to 10:04 a.m.	20	32	21	E	0	RR 215, 1.3km N of Twp Rd 554. Intermitent gas plant-type odours, depending on wind dir. Odours from Shell Refinery or Shell Chemicals plant, both plants upwind. Start canister #3.
	Site #14	11:01 a.m. to 12:01 p.m.	23	27	9	SW	80	Old Fort Trail & Lamoureux Dr. 11:05 AM -position is downwind of all industrial facilities.
	Site #2	12:08 p.m. to 1:08 p.m.	25	24	12	S	60	Rge Rd 231 between Hwy 15 & 37.
	Site #1	1:24 p.m. to 2:24 p.m.	27	20	8	W	20	34 St just N of 167 Ave at communication towers.
	Site #16	2:52 p.m. to 3:52 p.m.	28	17	10	N	0	Service rd on E side of Hwy 21.
	Site #12	4:50 p.m. to 5:50 p.m.	30	15	5	S	n/a	Brookville hall.

* Weather conditions are based on observations at the monitoring site. Units are temperature (°C), wind speed (km/h), and cloud cover (% of sky coverage).
V. indicates the wind was from variable conditions. n/a indicates no data available.

Table 14: Meteorological Data and Field Notes for the Fort Saskatchewan/Redwater area survey
Summer (July 18 to 20, 26 and 27, 2001).

Date	Monitoring Location	Time (MST)	Temp °C	RH %	WSP km/h	WDR	Cloud %	Operator's Remarks
18-Jul-01	Site #15	8:35 a.m. to 9:35 a.m.	19	47	7	S	0	n/a
	Site #17	9:49 a.m. to 10:49 a.m.	21	45	8	S	40	9:49 AM - Clouds moving in from the W.
	Site #3	11:04 a.m. to 12:04 p.m.	20	48	8	W	80	Ft. Sask. Jarvis Park.
	Site #4	12:32 p.m. to 1:32 p.m.	19	57	11	W	90	119 SIA 104 Ave. 12:32PM - Start canister sample. Faint intermittent chemical odours. 1:00PM - Wind mainly from Agrum Nitrogen operation & ponds. 1:14PM - 119 SIA95 Ave - no odours.
	Site #5	2:04 p.m. to 3:04 p.m.	20	53	9	SW	100	Rge Rd 214 & Twp Rd 560 @ fence line to Shell Scottford. 2:05 PM - Set out canister #2. Odours & elevated RHC (0.4 ppm). Note: small tractor mower on berm in front of MAMC along fence line.
19-Jul-01	Site #11	3:30 p.m. to 4:30 p.m.	21	46	7	SW	80	Bruderheim. 3:34 PM - re-orientate & face S.
	Site #13	4:45 p.m. to 5:45 p.m.	17	63	8	W	80	Lamont. 52nd & 52nd.
	Site #10	9:56 a.m. to 10:56 a.m.	17	74	16	SW	95	Thorhill.
	Site #8	11:15 a.m. to 12:15 p.m.	19	61	8	W	95	Egremont.
	Site #9	12:36 p.m. to 1:36 p.m.	20	55	13	W	80	n/a
	Site #7	1:58 p.m. to 2:58 p.m.	22	48	9	S	60	n/a
	Site #6	3:34 p.m. to 4:34 p.m.	21	54	10	S	n/a	1km N of Twp Rd 562 on Rge Rd 213A. 1 km E of Agrum Redwater. Variable W to E winds.
	Site #2	5:20 p.m. to 6:20 p.m.	21	55	11	W	30	Halfway between Hwy 15 & Hwy 37 on Rge Rd 231.
	Site #1	6:36 p.m. to 7:36 p.m.	20	65	3	SW	20	Service road on W side of Manning Freeway, 1 block N of 167 Ave.
	Site #13	9:18 a.m. to 10:18 a.m.	22	50	7	SE	10	Lamont.
20-Jul-01	Site #11	10:37 a.m. to 11:37 a.m.	23	45	8	S	10	Bruderheim.
	Site #4	12:13 p.m. to 1:13 p.m.	25	40	7	W	n/a	12:12 PM - Odours from a Natural Gas Regulating Stn. Sign says Dow Chemical/Spillover. River Lot #5. 12:15 PM - Elevated RHC & odours. Set out canister #3 - 4m from source.
	Site #3	1:26 p.m. to 2:26 p.m.	24	44	8	W	40	Jarvis Park in Ft. Sask.
	Site #14	2:41 p.m. to 3:41 p.m.	23	54	11	W	60	1km S of Hwy 15 on Lamaaroux Dr. 3:16 PM - Back up 6m & face S.
	Site #16	3:55 p.m. to 4:55 p.m.	22	47	16	W	75	Hwy 21 & Twp Rd 540.
26-Jul-01	Site #12	5:16 p.m. to 6:16 p.m.	21	48	15	W	80	Hwy 16 & Rge Rd 212. Brookville Hall.
	Site #7	9:21 a.m. to 10:21 a.m.	18	77	4	S	100	Redwater.
	Site #9	10:39 a.m. to 11:39 a.m.	18	80	4	SW	100	n/a
	Site #8	11:54 a.m. to 12:54 p.m.	18	72	6	S	100	Egremont.
	Site #10	1:10 p.m. to 2:10 p.m.	18	76	8	SW	100	n/a
	Site #6	2:44 p.m. to 3:44 p.m.	20	71	8	SE	100	Hwy 643 ~ 1km W of nearest stack at Agrum Redwater plant.
	Site #17	4:15 p.m. to 5:15 p.m.	21	63	5	S	95	Rge Rd 231 & Twp Rd 544. Dow Centennial Fields.
27-Jul-01	Site #15	5:31 p.m. to 6:31 p.m.	14	92	13	SE	95	Hwy 21 & Twp Rd 534. Storm & rain. 6:21PM - Elevated RHC H.S. TRS with W winds. H.S. peak of 10 ppb. ~40m E of MAMC, a lagoon may have gone anaerobic. Anaerobic odour. Heavy rain lately sited up the pond. 6:27PM - wind dir changed, now detecting traffic exit from Hwy 21.
	Site #1	6:26 a.m. to 9:26 a.m.	21	66	5	S	0	Start 1 hr. average. Clear sky. Light S wind.
	Site #2	9:39 a.m. to 10:39 a.m.	24	57	7	S	0	n/a
	Site #14	10:44 a.m. to 11:44 a.m.	26	46	4	SE	0	n/a
	Site #5	12:35 p.m. to 1:35 p.m.	24	47	9	SE	n/a	Shell Scottford. Set out canister #4 even though there are no odours or elevated readings. This location is downwind of Shell. Only very slight petro chemical odour.
	Site #16	2:06 p.m. to 3:06 p.m.	25	49	11	SE	10	Twp Rd 544 & Hwy 21.
	Site #12	3:25 p.m. to 4:25 p.m.	24	53	11	SE	n/a	Brookville Hall @ Rge Rd 212 & Hwy 16.

* Weather conditions are based on observations at the monitoring site. Units are temperature [°C], wind speed [km/h], and cloud cover [% of sky coverage].
V - indicates the wind was from variable conditions. n/a indicates no data available.

Table 15: Meteorological Data and Field Notes for the Fort Saskatchewan/Redwater area survey
Fall (November 7 to 9, 13 and 15, 2001).

Date	Monitoring Location	Time (MST)	Temp °C	RH %	WSP km/h	WDR	Cloud %	Operator's Remarks
7-Nov-01	Site #13	9:41 a.m. to 10:40 a.m.	1	62	4	SW	60	Lamont.
	Site #11	10:56 a.m. to 11:55 a.m.	2	60	8	SW	40	Bruderheim. 3:34 PM - re-orientate and face S.
	Site #5	12:20 p.m. to 1:20 p.m.	4	54	9	SW	20	Twp Rd 560A. 500m E of Rge Rd 215. N side of Shell Scotford. Slight petiochemical type odour. Set out canister sample #5. 12:23 PM - NO ₂ , PAH & particulates up. Visible haze.
	Site #4	1:55 p.m. to 2:55 p.m.	7	35	13	SW	20	Downwind of Sheritt on 119 St & 104 Ave. 1:57 PM - some NH ₃ odour. Particulates are lower than site #5, the air looks less hazy. Set out canister sample #6.
	Site #15	3:51 p.m. to 4:51 p.m.	4	44	11	S	20	Hwy 21 & Twp Rd 534.
8-Nov-01	Site #3	5:06 p.m. to 6:06 p.m.	2	56	7	S	20	Jarvis Park.
	Site #17	6:19 p.m. to 7:17 p.m.	0	70	9	S	0	Dow centennial fields.
	Site #10	10:08 a.m. to 11:08 a.m.	3	68	5	SW	80	Centennial Park in Thorhild.
	Site #8	11:35 a.m. to 12:35 p.m.	9	48	7	SW	80	n/a
	Site #9	12:47 p.m. to 1:47 p.m.	10	42	7	W	80	n/a
9-Nov-01	Site #7	2:08 p.m. to 3:08 p.m.	10	44	4	W	90	Depart site thru Redwater onto Hwy 38 S.
	Site #6	3:24 p.m. to 4:24 p.m.	8	56	5	SW	100	3:28 PM - Turn S onto Rge Rd 213A. 3:33 PM - Rge Rd 213A. 1 km N of Twp Rd 562 & 1.8 km E on Aghum Redwater. Wind has shifted to a more southerly direction.
	Site #2	5:22 p.m. to 6:15 p.m.	5	63	4	SW	90	n/a
	Site #1	6:35 p.m. to 7:35 p.m.	5	64	4	SW	n/a	Stop at 167 Ave. Steady traffic on Hwy 15 (Manning freeway) causing elevated readings.
	Site #12	10:25 a.m. to 11:25 a.m.	10	50	10	W	5	Brookville Hall.
13-Nov-01	Site #16	11:43 a.m. to 12:43 p.m.	10	47	9	W	5	Hwy 21 & Twp Rd 540. Road dust in the area.
	Site #3	12:57 p.m. to 1:57 p.m.	12	45	6	W	5	Jarvis park.
	Site #14	2:20 p.m. to 3:20 p.m.	10	52	4	SW	40	500m S of Hwy 15 overpass on Lamereaux Rd.
	Site #4	3:56 p.m. to 4:56 p.m.	8	59	6	S	90	Stop along 118 St 800m N of 99 Ave. 1.2 km from Sheritt stack.
	Site #11	5:26 p.m. to 6:26 p.m.	7	64	3	SE	n/a	n/a
15-Nov-01	Site #13	6:27 p.m. to 7:27 p.m.	5	71	7	S	n/a	Lamont.
	Site #15	9:07 a.m. to 10:07 a.m.	5	75	6	SW	90	n/a
	Site #17	10:22 a.m. to 11:22 a.m.	7	73	4	S	60	Dow fields. Elevated readings, pollution type blue grey haze in the valley area.
	Site #6	11:55 a.m. to 12:55 p.m.	11	56	4	S	40	Same site as Nov 8 on Rge Rd 213A, about 1km N of Twp Rd 562.
	Site #9	1:40 p.m. to 2:40 p.m.	13	47	5	W	20	Twp Rd 564.
15-Nov-01	Site #8	2:50 p.m. to 3:49 p.m.	12	51	2	E	10	Egmont town centre. Sacred Heart church.
	Site #10	4:05 p.m. to 5:05 p.m.	6	75	2	SE	10	Centennial park in Thorhild.
	Site #7	5:33 p.m. to 6:33 p.m.	3	88	2	S	0	Redwater Lions Park. 5:35 PM - woodsmoke-like odour, hazy in the area. Likely a localized source since air was clear a few miles S of Redwater after leaving the site.
	Site #12	9:41 a.m. to 10:41 a.m.	4	83	17	SE	95	n/a
	Site #16	11:15 a.m. to 12:15 p.m.	9	69	14	SE	100	11:16 AM - Elevated readings from traffic.
15-Nov-01	Site #5	1:00 p.m. to 2:00 p.m.	8	73	14	E	100	Downwind of the shell MEG plant. 650m NW of flare stack. The MEG plant is another 200m past the flare stack. No odours detected.
	Site #14	2:45 p.m. to 3:45 p.m.	7	76	6	E	100	400m S of Hwy 15 on Lamereaux Drive.
	Site #2	3:54 p.m. to 4:54 p.m.	6	80	8	E	95	n/a
	Site #1	5:15 p.m. to 6:15 p.m.	12	51	11	S	n/a	Normal freeway traffic.
	Site #1	5:15 p.m. to 6:15 p.m.	12	51	11	S	n/a	Normal freeway traffic.

* Weather conditions are based on observations at the monitoring site. Units are temperature [°C], wind speed [km/h], and cloud cover [% of sky coverage].
V : indicates the wind was from variable conditions. n/a indicates no data available.

Table 16: Meteorological Data and Field Notes for the Fort Saskatchewan/Redwater area survey
Winter (February 25 to 28, and March 1, 2002).

Date	Monitoring Location	Time (MST)	Temp °C	RH %	WSP km/h	WDR	Cloud %	Operator's Remarks
25-Feb-02	Site #15	9:44 a.m. to 10:44 a.m.	-12	50	4	W	0	Start 1 hour ave at site #15. Clear
	Site #17	10:56 a.m. to 11:56 a.m.	-10	41	4	SW	0	Dow Centennial Fields. Rge Rd 231 & Twp Rd 543
	Site #3	12:11 p.m. to 1:11 p.m.	-9	41	5	W	0	Fl. Saak town centre. Jarvis Park 1 Blk W of 101 St on 100 Ave
	Site #4	1:22 p.m. to 2:22 p.m.	-8	39	4	W	0	500m N of 99 Ave on 119 St. Plume from Sheritt coming toward MAML but wind too light to drive down. No odours & no readings around the plant. Did not do canister sample.
	Site #5	2:50 p.m. to 3:50 p.m.	-6	36	4	SW	0	100m W of Rge Rd 214 on Twp Rd 561. Downwind of Shell refinery. Plume is toward MAML but wind is too light to bring. No odours so no canister sample taken.
26-Feb-02	Site #5	4:27 p.m. to 5:27 p.m.	-9	55	10	S	n/a	Detect SO ₂ & NO _x from plant due to stronger winds from the SW. Set up canister #1933 for 1 hr sample at 1630. 5:10 PM - Some local traffic exn from staff shift change at Shell.
	Site #13	5:56 p.m. to 6:56 p.m.	-14	74	8	SE	0	Lamont.
	Site #10	10:34 a.m. to 11:34 a.m.	-5	63	12	W	100	n/a
	Site #8	11:50 a.m. to 12:50 p.m.	0	65	6	W	100	Egremont Church.
	Site #9	1:02 p.m. to 2:02 p.m.	1	60	13	NW	100	Redwater River valley bridge.
26-Feb-02	Site #7	2:31 p.m. to 3:31 p.m.	2	50	12	NW	60	Redwater Lions Park. 5:35 PM - woodsmoke-like odour, hazy in the area. Likely a localized source since air was clear a few miles S of Redwater after leaving the site.
	Site #6	4:02 p.m. to 5:02 p.m.	1	54	10	NW	40	Twp Rd 562 & Rge Rd 213A. Pick up odours from Agrum.
	Site #11	5:25 p.m. to 6:25 p.m.	-2	65	10	W	40	Bruderheim. 5:27 PM - local traffic exhaust.
	Site #2	6:52 p.m. to 7:52 p.m.	-4	76	11	NW	n/a	Hwy 15 & 37 on Rge Rd 231.
	Site #1	8:06 p.m. to 9:06 p.m.	-2	71	15	W	n/a	167 Ave & Manning Fwy.
27-Feb-02	Site #12	8:34 a.m. to 9:34 a.m.	-4	67	3	SE	100	Brookville.
	Site #13	10:05 a.m. to 11:05 a.m.	-5	48	5	SE	80	Lamont town center.
	Site #11	11:28 a.m. to 12:28 p.m.	-4	45	7	E	90	n/a
	Site #4	1:02 p.m. to 2:02 p.m.	-2	47	6	E	100	119 St & River Road. 1:03 PM - Picked up NH ₃ from Dow while stopping at site.
	Site #3	2:21 p.m. to 3:21 p.m.	-3	50	7	E	100	Fl. Saak. center.
28-Feb-02	Site #14	3:40 p.m. to 4:40 p.m.	-5	53	11	E	100	Lamereaux Rd. E wind picking up during the hour.
	Site #16	4:57 p.m. to 5:57 p.m.	-5	65	11	E	100	Stop at Site #16 on Hwy 21.
	Site #6	9:36 a.m. to 10:36 a.m.	-17	59	5	NE	60	Corner of Rge Rd 220 & Hwy 643. Downwind of Agrum. No odours but occasional slight increase in NH ₃ & SO ₂ . Light winds. Plume traveling overhead 1 mi W of Agrum.
	Site #7	10:52 a.m. to 11:52 a.m.	-11	41	4	SW	40	Redwater Lions Park.
	Site #8	12:14 p.m. to 1:14 p.m.	-11	42	3	E	80	Egremont. 51 St & 51 Ave.
28-Feb-02	Site #9	1:28 p.m. to 2:28 p.m.	-12	50	7	SE	40	Redwater River Valley. Light snow near end of hour.
	Site #10	2:51 p.m. to 3:51 p.m.	-13	59	4	SE	n/a	Thorfield. Light snow during the hour.
	Site #17	5:13 p.m. to 6:13 p.m.	-14	84	7	NE	n/a	Dow Centennial Field. Light snow.
	Site #15	6:23 p.m. to 7:23 p.m.	-15	88	9	N	100	Twp Rd 534 on W side of Hwy 21. Snow has stopped.
	Site #12	9:36 a.m. to 10:36 a.m.	-13	62	5	SW	0	n/a
1-Mar-02	Site #16	10:53 a.m. to 11:53 a.m.	-14	62	9	NW	0	n/a
	Site #5	12:34 p.m. to 1:34 p.m.	-12	47	9	W	0	2.4 km N of Hwy 15 on Rge Rd 213. Downwind of Shell refinery. 12:37 PM - Plume going over MAML. No odours. Refinery 1 mi W of MAML. 12:40 PM - Pick up slight SO ₂ .
	Site #14	2:03 p.m. to 3:03 p.m.	-12	51	5	SW	0	1.7 km S of Hwy 15 on Lamereaux Rd.
	Site #2	3:10 p.m. to 4:10 p.m.	-9	46	4	W	0	Between Hwy 15 & 37 on Rge Rd 231. Road dust from local traffic.
	Site #1	4:24 p.m. to 5:24 p.m.	-11	56	8	SW	0	n/a

* Weather conditions are based on observations at the monitoring site. Units are temperature [°C], wind speed [km/h], and cloud cover [% of sky coverage].

V - indicates the wind was from variable conditions. n/a indicates no data available.

Table 17: VOC concentrations in the Fort Saskatchewan/Redwater area.

Volatile Organic Compound Concentrations in the Fort Saskatchewan/Redwater area (µg/m ³)																											
Volatile Organic Compound	Site #4	Site #5	Site #6	Jul-01			Nov-01			Feb-02			Maximum	Average	Alberta One-hour Guideline*	Ontario Half-hour Point of Impingement Limit ^b	Ontario Ambient Air Quality Criteria ^b			Odour Threshold Range ^c							
	16 ^h	18 ^h	23 ^h	16 ^h	18 ^h	20 ^h	27 ^h	Site #5	7 ^h	10 ^h	14 ^h	Site #4					7 ^h	9 ^h	10 ^h		25 ^h	27 ^h	24 Hour	1 Hour	Other	Low	High
	16 ^h	18 ^h	23 ^h	16 ^h	18 ^h	20 ^h	27 ^h	Site #5	7 ^h	10 ^h	14 ^h	Site #4					7 ^h	9 ^h	10 ^h		25 ^h	27 ^h	24 Hour	1 Hour	Other	Low	High
1,1,1-Trichloroethane	0.240	0.240	0.240	0.960	1.400	1.000	1.040	0.225	0.250	0.169	0.224	0.212	0.000	0.000	0.000	350000		115.000				21000	35000				
1,1,2-Tetrachloroethane	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000												
1,1,2-Trichloroethane	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.080	0.000	0.000	0.000	0.000	0.007	0.080													
1,1-Dichloroethane	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.132	0.000	0.005	0.008	0.008	0.013	0.132					200			1031422					
1,1-Dichloroethene	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.018	0.000	0.000	0.000	0.000	0.002	0.018													
1,2,3-Trimethylbenzene	0.040	0.040	0.000	0.000	0.000	0.040	0.000	0.084	0.008	0.037	0.124	0.012	0.032	0.124								24000					
1,2,4-Trichlorobenzene	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.015	0.018	0.012	0.056	0.036	0.011	0.056													
1,2,4-Trichlorobenzene	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.276	0.028	0.123	0.544	0.048	0.135	0.544				1000									
1,2,4-Trimethylbenzene	0.080	0.080	0.040	0.160	0.120	0.080	0.040	0.000	0.000	0.000	0.008	0.008	0.001	0.008				500				76800					
1,2-Dibromoethane (EDB)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.016	0.012	0.003	0.016								12000	30000				
1,2-Dichlorobenzene	0.120	0.040	0.040	0.000	0.680	0.000	0.000	10.392	0.038	0.026	0.052	0.064	0.954	10.392								77255					
1,2-Dichloroethane	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000								1167	606666				
1,2-Dichloropropane	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.008	0.000	0.004	0.008	0.004	0.002	0.008													
1,2-Diethylbenzene	0.040	0.040	0.040	0.040	0.040	0.040	0.000	0.076	0.008	0.036	0.136	0.012	0.042	0.136													
1,3,5-Trimethylbenzene	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.111	0.011	0.048	0.148	0.028	0.029	0.148													
1,3-Butadiene	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.020	0.005	0.010	0.028	0.008	0.016	0.080								352	2860				
1,3-Dichlorobenzene	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.056	0.016	0.016	0.044	0.020	0.019	0.056													
1,3-Diethylbenzene	0.080	0.040	0.000	0.000	0.000	0.000	0.000	0.000	0.005	0.000	0.020	0.012	0.003	0.020													
1,4-Dichlorobenzene	0.040	0.040	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.080													
1,4-Dichlorobutane	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.079	0.000	0.000	0.000	0.007	0.079													
1,4-Diethylbenzene	0.080	0.040	0.040	0.000	0.000	0.000	0.000	0.054	0.011	0.024	0.000	0.000	0.021	0.080													
1-Butene/2-Methylpropene	0.200	0.240	0.160	0.240	0.240	0.240	0.160	0.670	0.421	0.469	1.512	1.320	0.489	1.512													
1-Butyne	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.016	0.000	0.000	0.008	0.000	0.002	0.016				180000									
1-Bulyne	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000													
1-Decene	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000													
1-Heptene	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000													
1-Hexene/2-Methyl-1-Pentene	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000													
1-Methylcyclohexene	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000													
1-Methylcyclopentene	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.014	0.000	0.009	0.032	0.004	0.005	0.032													
1-Nonene	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.036	0.000	0.000	0.000	0.000	0.011	0.092													
1-Octene	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.293	0.000	0.009	0.000	0.348	0.054	0.348				50000									
1-Pentene	0.000	0.040	0.000	0.080	0.000	0.000	0.000	0.123	0.018	0.051	0.108	0.116	0.045	0.123													
1-Undecene	2.360	0.800	3.640	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.216	0.748	0.947	3.640													
2,2,3-Trimethylbutane	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.024	0.000	0.002	0.024													
2,2,4-Trimethylpentane	0.040	0.080	0.040	0.200	0.160	0.000	0.000	3.106	0.072	0.219	1.840	0.112	0.489	3.106													
2,2,5-Trimethylhexane	0.120	0.000	0.000	0.000	0.000	0.000	0.000	0.042	0.000	0.016	0.044	0.008	0.019	0.120													
2,2-Dimethylbutane	0.000	0.000	0.000	0.000	0.000	0.120	0.000	0.181	0.000	0.085	0.164	0.032	0.049	0.181													
2,2-Dimethylhexane	0.040	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.000	0.003	0.040													
2,2-Dimethylpentane	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.068	0.000	0.018	0.068	0.012	0.014	0.068													
2,2-Dimethylpropane	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000													

a. Alberta Ambient Air Quality Guidelines, Alberta Environment, February 2000.
 b. Summary of Points of Impingement Standards, Points of Impingement Guidelines and Ambient Air Quality Criteria (AAQCs), Standards Development Branch, Ontario Ministry of the Environment, September 2001.
 c. Colour thresholds from the 1986 paper entitled "Colour Thresholds and Impaction Levels of Several Chemical Substances, A Review" published by the American Industrial Hygiene Association and the "3M 2001 Respirator Selection Guide" available at www.3m.com.

Table 17: VOC concentrations in the Fort Saskatchewan/Redwater area continued

Volatile Organic Compound	Volatile Organic Compound Concentrations in the Fort Saskatchewan/Redwater area (µg/m ³)																							
	Site #4			Site #5			Site #6			Site #7			Site #8			Site #9			Site #10			Site #11		
	16 th	18 th	23 rd	16 th	18 th	23 rd	16 th	18 th	23 rd	16 th	18 th	23 rd	16 th	18 th	23 rd	16 th	18 th	23 rd	16 th	18 th	23 rd	16 th	18 th	23 rd
c-2-Butene	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
c-2-Heptene	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
c-2-Hexene	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
c-2-Pentene	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
c-3-Heptene	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
c-3-Methyl-2-Pentene	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
c-4-Methyl-2-Pentene	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Camphene	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
Carbon tetrachloride	0.680	0.680	0.720	0.520	0.680	0.480	0.520	0.680	0.480	0.520	0.680	0.480	0.520	0.680	0.480	0.520	0.680	0.480	0.520	0.680	0.480	0.520	0.680	0.480
Chlorobenzene	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Chloroethane	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Chloroform	0.080	0.080	0.040	0.120	0.200	0.080	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Chloromethane	1.200	1.240	1.240	0.720	1.320	1.040	1.040	1.032	1.368	0.905	1.168	1.212	1.124	1.369	0.888	0.888	0.888	0.888	0.888	0.888	0.888	0.888	0.888	0.888
Cyclohexane	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Cyclohexene	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Cyclopentane	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Decane	0.160	0.280	0.200	0.200	0.120	0.120	0.080	0.299	0.056	0.102	0.240	0.120	0.165	0.299	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Dibromochloromethane	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Dibromomethane	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Dichloromethane	24.920	31.600	58.360	22.640	1.280	21.240	17.360	9.311	0.217	0.508	0.488	0.188	14.978	58.360	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Dodecane	0.240	0.120	0.000	0.400	0.240	0.000	0.200	0.208	0.064	0.143	0.164	0.380	0.180	0.400	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Ethane	4.439	6.537	2.999	no data	no data	no data	no data	17.066	8.181	7.456	6.084	5.295	7.257	17.066	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Ethylbenzene	0.080	0.080	0.080	0.280	0.160	0.120	0.960	0.838	0.095	0.281	0.776	0.060	0.317	0.960	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Ethylbromide	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Ethylene	0.697	1.166	0.522	1.720	1.680	1.720	1.520	1.840	1.480	1.520	1.771	2.161	1.422	1.682	2.161	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Freon 11 (Trichlorofluoromethane)	0.680	0.680	0.720	0.640	0.760	0.640	0.640	0.640	0.760	0.640	0.638	0.807	0.533	0.612	0.600	0.663	0.807	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Freon 113 (1,1,2-Trichloro-1,2,2-difluoroethane)	0.120	0.120	0.160	0.120	0.200	0.160	0.160	0.160	0.200	0.160	0.147	0.190	0.124	0.132	0.147	0.200	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Freon 114 (1,2-Dichloro-1,1,2,2-tetrafluoroethane)	2.680	2.760	2.800	1.760	3.240	2.560	2.760	3.033	3.682	2.470	2.624	2.496	2.739	3.682	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Freon 12 (Dichlorodifluoromethane)	0.520	0.520	0.520	0.440	0.640	0.520	0.520	0.520	0.640	0.520	0.773	0.677	0.572	0.732	0.572	0.584	0.773	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Freon 22 (Chlorodifluoromethane)	0.080	0.080	0.080	0.240	0.200	0.280	0.000	0.000	0.240	0.200	0.801	0.100	0.177	0.688	0.224	0.246	0.801	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Heptane	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Hexachlorobutadiene	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Hexane	0.080	0.200	0.160	1.160	0.600	0.880	0.000	0.000	1.160	0.600	1.992	0.165	0.361	1.348	0.520	0.606	1.992	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Hexylbenzene	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Indan (2,3-Dihydroindene)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Isobutane (2-Methylpropane)	0.400	0.360	0.520	0.880	1.440	0.880	0.360	10.659	1.016	1.603	3.932	1.156	2.184	10.659	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
iso-Butylbenzene	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Isoprene (2-Methyl-1,3-Butadiene)	0.000	0.000	0.120	0.600	0.640	0.800	0.480	0.052	0.000	0.035	0.156	0.052	0.245	0.800	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

a. Alberta Ambient Air Quality Guidelines. Alberta Environment, February 2006.
b. Summary of Point of Impingement Standards, Point of Impingement Guidelines and Ambient Air Quality Criteria (AAQC). Standards Development Branch, Ontario Ministry of the Environment, September 2001.
c. Other Prescribed from the 1986 paper entitled "Other Thresholds and Impingement Levels of Several Chemical Substances: A Review" published by the American Industrial Hygiene Association and the "M2001 Respiratory Selection Guide".
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